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A Successful Shop Suggestion System

How a Large Agricultural Implement Manufacturer Has Secured Ideas for Improvements in Product and Working Conditions

BY H. A. RUSSELL

IT has been wisely said that "the proof of the pudding is in the eating." A suggestion system cannot very well be eaten, but if it is well digested and the patient seems to receive benefit from the treatment, it is an indication that the prescription had some merit. The system which will be described in this article has been in actual use for about three years. It is being conducted to-day in the same manner as originally planned.

The suggestions are gathered in twice a month, on the first and fifteenth. Naturally as time goes on the number of suggestions becomes less each time the collections are made, but the quality improves. At first we got suggestions on everything in this world and beyond, interspersed with good ideas, however. Sometimes the ideas are very vague; the meaning is hidden. We have found that it is a paying proposition to talk the matter over with the person sending in the suggestion when the meaning is not clear. When the meaning cannot be mistaken the questions of adaptability and the amount of the payment are decided without the Suggestion Committee knowing the name of the employee who sent in the suggestion. In other words, the matter is decided entirely on its own merits.

At the inception of the system the following printed leaflet was put in each employee's pay envelope. This, however, did not include the office force, foremen or assistant foremen. It is certainly the duty of these employees to make suggestions without extra payment for so doing. The printed instructions read as follows:

Suggestions from our employees will be welcomed, and will be paid for if of value and put into use.

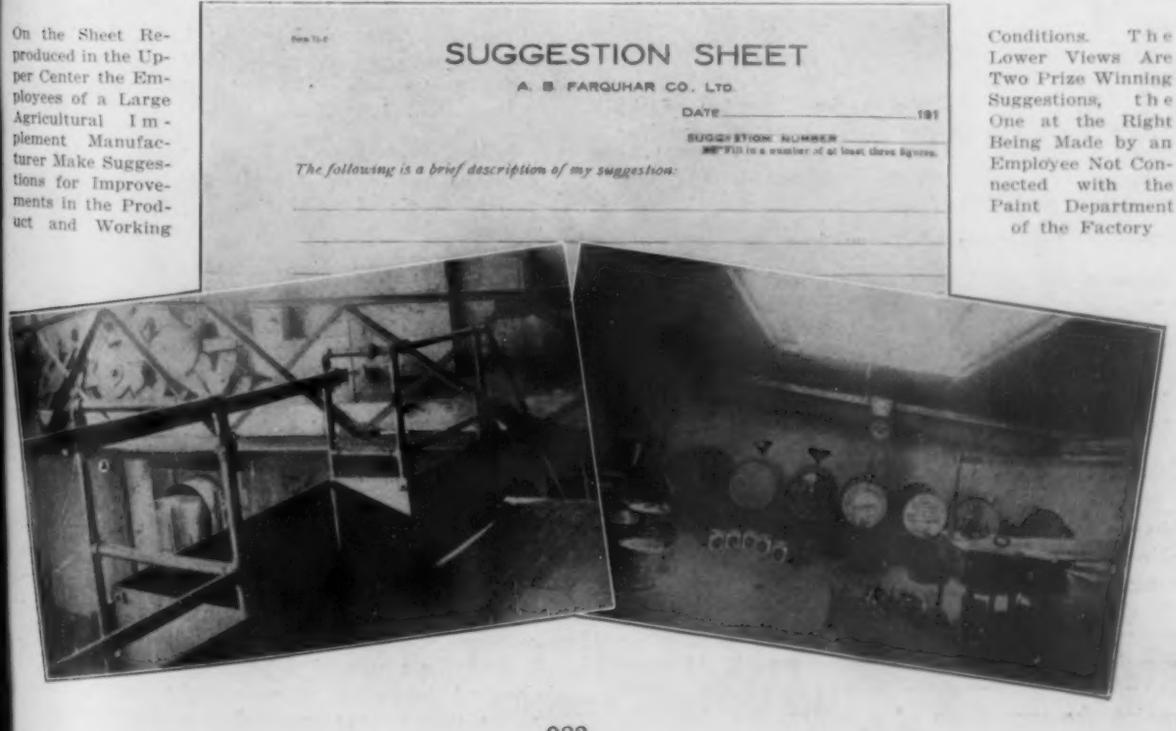
No particular forms are necessary, but we hereby explain our plans devised for the purpose of obtaining the best results.

1. It is requested that the person making the suggestion does not sign his name; we wish the merits of the suggestion to be passed upon without any regard to the position of the person making them.

2. A method is provided whereby the author of the suggestion can identify himself in case it is accepted; if not accepted he need not disclose his name.

3. The names of those whose suggestions are accepted will be posted upon the bulletin boards from time

On the Sheet Reproduced in the Upper Center the Employees of a Large Agricultural Implement Manufacturer Make Suggestions for Improvements in the Product and Working Conditions. The Lower Views Are Two Prize Winning Suggestions, the One at the Right Being Made by an Employee Not Connected with the Paint Department of the Factory



to time, together with a brief statement of the merit of the improvement or other valuable idea accepted. (Where, however, the winner does not desire his name disclosed, the name will be omitted.)

4. Payment for the suggestions accepted will be made promptly after acceptance, in accordance with a schedule of amounts fixed beforehand and depending upon the nature and value of the suggestion.

5. Details as to how the suggestions may be handed in, what subjects they may cover, and other necessary information, are given beyond.

To briefly summarize the additional details that were a part of the printed leaflet, certain parts will be quoted:

Please use the printed form of suggestion sheet.

Suggestion boxes are located close to the time-slip boxes, in each department. Place your unsigned suggestions in these boxes at any time.

There is a space provided at the top of the suggestion sheet for the number you choose. The number should have at least three figures (326, for instance).

The number is for the purpose of letting you know whether your suggestion has been successful, or not. The Suggestion Committee will post the winning numbers upon the bulletin boards. If one of these numbers is yours, you are requested to notify your foreman or assistant foreman or one of the time clerks. This will enable the committee to see that you get proper payment for your suggestion, and to give you proper recognition and credit for it by posting your name (unless you request that your name be not posted), together with a brief description of your valuable idea.

If anyone whose suggestion is not adopted will communicate with the committee the reason for its rejection will be explained to him.

All suggestion boxes are locked. Collections will be made about the first and fifteenth of each month. Each suggestion will be carefully considered by the committee upon its merits. No suggestion will be rejected except after being found to be of no value, or of insignificant value, by at least three-fourths of the committee.

Suggestions may include the following subjects:

Improvements In		
Our Product	Factory and Office Conditions	Miscellaneous
Quality	Health	Machines
Cost	Cleanliness	Tools
Quantity	Sanitation	Operations
Simplicity	Ventilation	Jigs and templates
Reliability	Order	Dies and forms
Packing	Prevention of fire	Transportation of materials
Shipping	Prevention of accident	Storage of supplies
Handling	Lighting	Complaints of existing conditions, coupled with suggested remedy for same
Routing	Power	
Finish	Economy	
Design		
Workmanship		
Material		

Awards will be entirely at the discretion of the committee. The committee will, however, consider themselves bound to distribute awards somewhat in accordance with the following classifications of suggestions, values and amounts.

Classes of Suggestions

Suggestions which are neither original, nor of appreciable money value, but which should be adopted, perhaps being modified before adoption.

Suggestions which, while having no appreciable money value, may be the means of avoiding an accident.

Suggestions which are not original, but of real money value.

Suggestions which are original and have some money value.

The awards range from $1 up to $10. This higher amount will be increased whenever the suggestion contains unusual merit. It is sometimes necessary to trace back the origin of a suggestion. It is quite possible for an employee to overhear a conversation between two foremen who may be discussing some particular improvement. A suggestion will be turned in by the employee. If it contains the expression of a better idea than developed from the foremen's talk, the employee is, of course, entitled to an award.

The percentage of suggestions that have been accepted and paid for has averaged, in three years, almost 30 per cent. The average would be higher were it not for the fact that duplicates and triplicates of the same suggestion are turned in. The suggestion with the prior date receives the award. If a suggestion is turned in that may refer to some matter that has been discussed at the weekly meeting of department heads, the employee is given an award, if his suggestion is the cause of bringing the matter to a head and the change or improvement is to be made. While the employee has no opportunity of learning what has been discussed at the meeting, he would naturally feel that his suggestion must have had merit or it would not have been adopted. At least he feels that it is his suggestion that has been carried into effect.

Many good suggestions have been turned in. A number of them have covered subjects with which the suggestor would have but little acquaintance, and yet the germ of the right idea was there. In some of the implements manufactured here there will be but a very small difference in the diameter of the cold-rolled shafts. Possibly for years the difference in the diameter of the shafts in two styles of corn shellers may have been only 1/16 in. Nobody paid any attention to the matter until the suggestion system started. Then a suggestion came in, the shafts were made of a uniform size and the required stock of cold-rolled steel was reduced, and instead of having to machine two sizes of shaft boxes the one size would do for both styles of corn shellers.

To mention one or two awards that were given, and which indicated a certain amount of thought on the part of the suggestor, the following will serve as examples of a great many more that have been received:

> Place a window in the door of the room used by the outside carpenters for the storage of tools. This will permit the watchman detecting a fire in this room before it gets much headway.

Investigation showed that a fire could have had a good start before the watchman could have seen it, unless he had made a practice of going off his usual route. The window has been put in and the watchman can see the reflection of a flame a considerable distance away and on his regular route.

Another suggestion was as follows:

> Put a chain hoist on an overhead movable carriage in the paint vault for raising the heavy barrels of paint from the floor to the bucks.

This latter suggestion came from a man who did not work in the paint department, but who had been sent there one day by his foreman with a message. Before this suggestion was adopted it had been necessary to gather three or four men together and by hard work roll the barrels, weighing 700 to 800 lb., up the skidway. There was, of course, the chance of an accident, while with the hoist there is hardly a possibility that the operator can get hurt.

Another suggestion resulted in the landing platform shown being built. The stockroom is close to this landing, and a 15-ton traveling crane passes overhead. When a heavy box or barrel was to be brought up from the first floor to the stockroom, a small chain was passed around the box or barrel and hooked into the rings on the crane chain. When the gallery was reached it was necessary to

start swinging the crane chain so as to bring the package in past the railing. The heavier the package, the more danger was there connected with the operation. Now, with the new platform, it is not necessary to swing the chain out of the perpendicular, and the danger is eliminated.

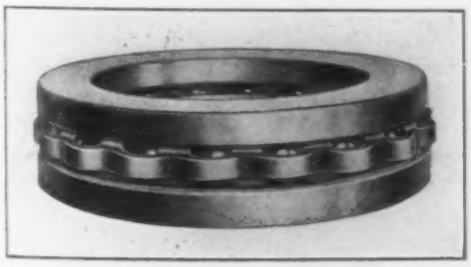
We have a separate Safety Committee,* or rather committees, whose duty it is to make all the suggestions they can, so as to avoid the possibility of accidents of any nature. If an employee not on the safety committees turns in a suggestion covering the matter of prevention of accidents he is given an award. There is a factory fire department, well equipped and interested. The members make suggestions regarding equipment, placement of ladders and fire escapes, etc., but even with the manifest interest the members have shown, occasionally some other employee will turn in a suggestion that pertains directly to the prevention of fire or the method of fighting a fire that makes the fire department kick itself, individually and collectively.

If I were to summarize the good points of a properly planned suggestion system, it would be necessary to state that it not only develops new ideas among the workers, but brings out the old ideas. Have you never had a man in the shop say to you: "I often wondered why you did not make that improvement before"? If that man had known that it was worth money to him to have called some one's attention to the improvement, he would not have waited until the improvement went into effect before expressing his opinion.

New Thrust Bearing of the Ball Type

A line of ball thrust bearings distinguished by the use of a solid brass ball retaining ring has been placed on the market by the Rochester Ball Bearing Company, Inc., Rochester, N. Y. This arrangement has been adopted in place of sheet metal retainers which sometimes wear rapidly and permit particles of steel to fall into the races. This subjects the balls, as they run over these particles, to shock and extra wear which will eventually ruin the bearing.

Ordinarily these bearings are made with either round grooves for general use or a V-groove for high-speed, light-duty conditions, but special bearings can also be



In This Recently Developed Ball Thrust Bearing a Solid Brass Ring Is Employed as a Ball Retainer

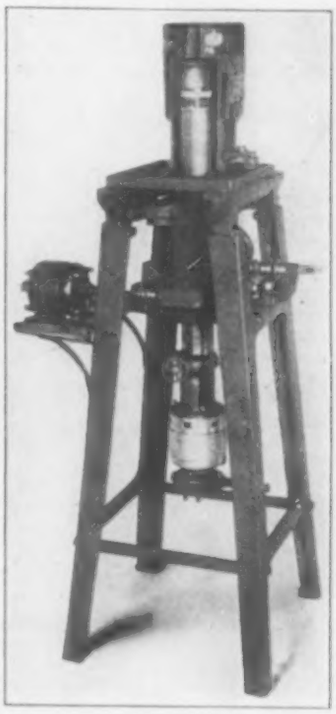
made to order. Self-aligning spherical seat washers are provided on the thrust bearings intended for heavy work. In the larger sizes of bearings the retainers are scalloped as shown, but are not in the smaller ones.

The Clarage Fan Company, Kalamazoo, Mich., now has a branch office in Chicago to care for local inquiries for fan equipment. The office is in charge of L. O. Monroe, and is located at 123 West Madison Street.

*The method of organizing these committees and the way in which they perform their duties was the subject of an illustrated article in THE IRON AGE, July 8, 1915. A description of the factory fire department also mentioned and the work it is doing to reduce the fire hazard in the plant appeared in THE IRON AGE, Sept. 30, 1915.

An Internal Cylinder Grinding Machine

The Reno-Kaetker Electric Company, Cincinnati, Ohio, has recently perfected an internal grinding machine primarily intended for grinding automobile cylinders. Its use in general machine shop-work is said to be very satisfactory, especially where accuracy is an important proposition. The machine only weighs 400 lb., and as a consequence it is easily transported, and its cost is within the reach of the smaller jobbing machine shops.



An Internal Type of Grinding Machine for Automobile Cylinders and also for General Machine Shop Work in Which the Work Holding Table Can Be Tilted to Any Angle for Convenience in Grinding

As will be noted, the machine consists of a vertical bar with a circular rack which is fed around and down at the same time by the horizontal motor operating through gearing. Inside the main bar is a sleeve which contains the grinding spindle. This sleeve is eccentric to the main bar, which permits grinding cylinders of different sizes. Flexibly coupled to the grinding spindle is a vertical motor which revolves the grinding wheel at a high speed. A hand-wheel is provided for increasing or decreasing the throw of the grinding wheel for various sized cylinders and for regulating the depth of cut to be made. The whole operation of setting up and grinding takes very little time, and after a little experience with the machine a good mechanic, it is emphasized, can produce rapid and accurate work.

The capacity of the machine is for cylinders from 3¼ to 5½ in. in diameter with a cut 10¼ in. long. The machine is 45 in. from the floor line to top of bed plate and takes a floor space of only 2 sq. ft. The bed of the machine is 12 in. wide by 20 in. long. The face plate is 12 in. wide by 15 in. long with an elongated hole.

The main bar is raised by hand and a shifting rod is provided for automatically feeding this bar up or down. The hand adjustment for revolving the main bar and for tilting the face plate is also a feature of the machine so that the cylinders can be placed at the proper angle for grinding.

The Electrical Alloy Company, Morristown, N. J., recently purchased a tract of land for the purpose of considerably increasing its manufacturing facilities. The first new building, 101 x 160 ft., is under way and will be ready for occupancy by Dec. 1. The company is doubling its annealing capacity and adding extensively to its machinery to take care of its increasing business. Its products are round, flat and shape wire and strips in special alloys and pure metals, its specialty being resistance wire extensively used for motor-starting boxes, field rheostats, electrical instruments, heating devices, etc. The new plant is located along the Erie Railroad, with a siding entering the factory.

The Carbo Corporation, manufacturer of steel poles and fence posts, has moved its main office from Chicago to the factory at Chicago Heights, Ill., in order to be able to fill orders more promptly.

Structure and Properties of Steel Ingots*

Advantages of Casting Wide End Up—Use of the Hot Top—Segregation and Ghost Lines—Effect of High Casting Temperature

BY A. W. AND H. BREARLEY

NOTHING can be done to prevent the shrinking of fluid steel as it passes from the liquid to the solid state; and the only means of providing against the inconvenience of it is to arrange for fluid metal to be kept at a higher level ready and able to flow into what otherwise would be a shrinkage cavity. This means that an ingot must always solidify from the bottom upward, which it does naturally when cast into a taper mold with the wide end up; or in general terms, the metal in any plane must solidify earlier than the metal in any higher plane if shrinking cavities are to be avoided.

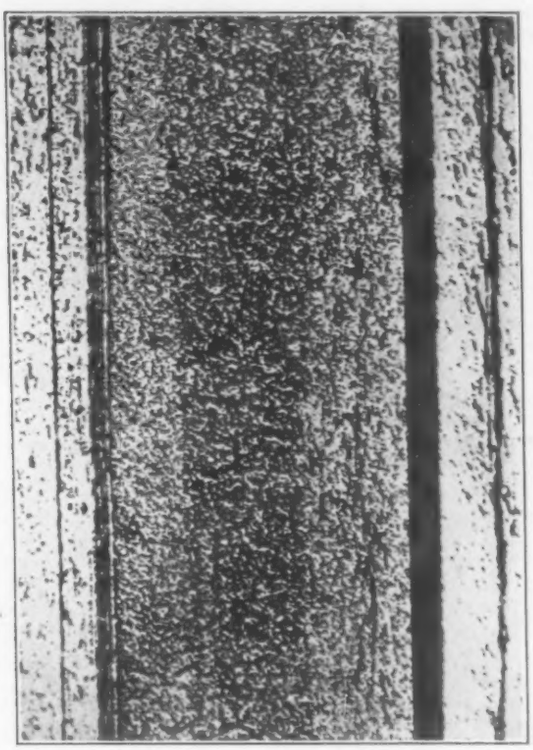


Fig. 9—A Bar Split Longitudinally, Disclosing the Soft Center

ADVANTAGES OF WIDE END UP

A fluid ingot cast with the wide end up shortens less rapidly than one cast with the narrow end up, and it is therefore more likely that the upper crust of frozen metal will resist the pressure of the atmosphere when the fluid underneath ceases to support it. This to some not very great extent will help to keep the upper and interior part of the steel fluid; it is more valuable, however, because it may prevent oxidation of the interior of the pipe and thus facilitate its welding when it comes later to be rolled or forged. It may also be observed that the pipe in one case takes the form of a long pointed cavity and in the other a short cavity with rounded end. Apart from the relative volumes of material thus made unsound, and likely to be scrapped, the former, occurring in ingots cast with the narrow end up, is more likely to cause ingots to clink in the reheating furnaces.

These are all points of minor importance in themselves, but experience shows that they lead sometimes to grave consequences, and it is therefore worth while to note that in these minor respects the soundness and reliability of the ingot are improved by casting with the wide end up.

The disadvantage of a shrinkage cavity whose surface has been oxidized by exposure to the atmosphere is recognized no matter in what kind of steel it occurs; but it is widely believed that other kinds of shrinkage cavities will weld up without the steel being any the worse. Such a view is not quite in harmony with actual experience, and it may be said that the question is not and cannot be quite settled, as has been inferred, by boring holes into ingots or cogged bars, and then, after sealing hermetically, observing their behavior on forging.

The central and unoxidized shrinkage cavities lying in straight-sided ingots below the feeder head were at one time during the progress of setting filled with liquid steel which fed the crystallites of purer metal growing from the walls of the cavity. But while the fluid metal sank downward the crystallites remained, and when the ingot becomes a billet or bar that part of it formed by the free-standing crystallites is purer, *i. e.*, contains less carbon and other segregating elements than the surrounding material.

This means, of course, that some part of the bar or bars will have a soft center and cause disappointment if made into chisels or drills, or if made into accurately drilled objects, such as rifle barrels. This kind of defect is most clearly visible to the naked eye in the fracture of steels containing between 0.90 and 1.1 per cent of carbon, but it can also be detected in lower and higher carbon steels by polishing and etching. The position of a soft center in a steel bar is the same as that of a hard center, and the one may occur not far behind the other. Fig. 9 is a photograph of a bar which has been split longitudinally in order to disclose the soft center.

The harder the steel the more important it becomes that the ingot should be free from these axial cavities, and that not only because the danger of clinking is greater and the chances of welding up the cavities are less, but because the harder material at forging or rolling temperatures is less ductile, and under distortion the cavities may actually extend.

CASTING HIGH-SPEED STEEL INGOTS

This observation is notably verified by the behavior of high-speed steel, and on that account ingots of high-speed steel ought always to be cast in taper molds with

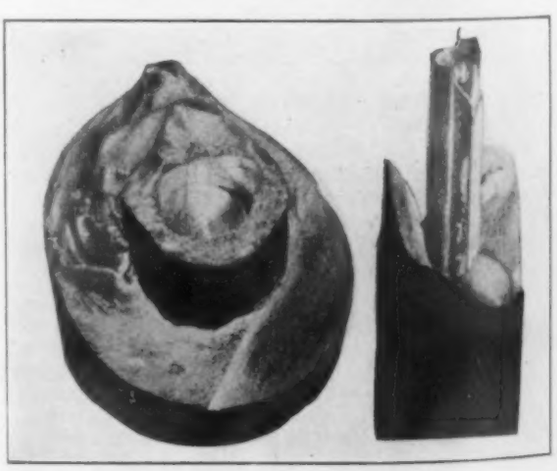


Fig. 10.—Defects in Hard Steel Bars, Unweldable and Originating from Cavities Existing Near the Axis of the Ingot

*Concluding portion of abstract of a paper presented at the autumn meeting of the Iron and Steel Institute in London, England, Sept. 22, 1916. The preceding portion appeared in THE IRON AGE, Oct. 26, 1916.

the wide end up and fed by means of a white hot sleeve or dozzle. The neglect of this precaution is one of the contributory causes to which the well-known splitting along their length of high-speed steel tools may be ascribed. Fig. 10 shows examples of defects in self-hard steel bars, unweldable at any temperature, which originate from cavities existing near the axis of the ingot.

The inverted taper mold is not generally used for ingots whose wider end is less than 4 in. across; the reason being that, with the usual taper, the narrower end becomes too small to be struck directly by the molten stream without fear of its having previously impinged on the side of the mold. When a stream of molten steel strikes the side of the mold the ingots are said to be "catched." A catched ingot is regarded as objectionable because it scars the surface of the ingot and may lead either to a lamination, akin to a lap, or a roak on the surface of the bar. On the surface of very hard steel, notably on self-hard steel ingots, a "catch" may lead to deep transverse cracks in the forged bar.

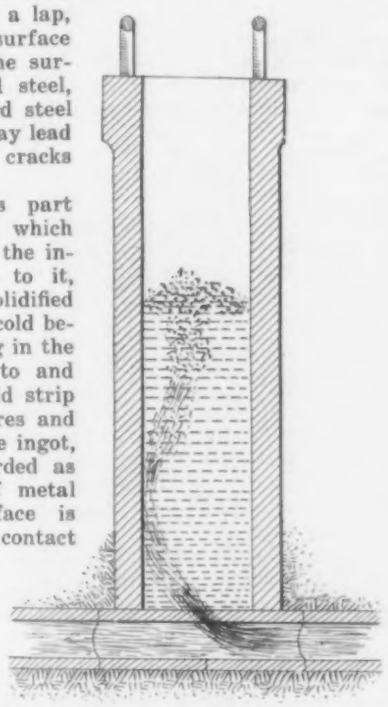


Fig. 11—Effect of Sloped Opening in a Runner Brick

In many cases part of the fluid steel which strikes the side of the ingot mold adheres to it, and is not only solidified but comparatively cold before the steel rising in the mold reaches up to and covers it. The cold strip of steel then adheres and becomes part of the ingot, and may be regarded as an inlaid strip of metal whose inner surface is more or less in contact with the ingot. The strip, however, never melts, and its temperature does not become equal to that part of the ingot in which it lies.

It may also be observed that the material immediately beneath a catch is spongy. The sponginess is caused by oxidation of the surfaces of the strip of steel before the metal rising in the ingot mold covers it. The oxide film reacts with the carbon of the fluid metal, as soon as the two come into contact, and small quantities of carbon monoxide or dioxide gases are liberated just as though that part of the ingot mold were rusted.

SOUND INGOTS

One speaks of sound ingots in a comparative sense. Absolute soundness is never attained, but the imperfections which give rise to no blemish or defect in the intermediate or final stages of manufacture are disregarded; and if they are also equally unobjectionable in the use of the article they are commercially negligible. It may happen, however, that apparent trifles arising in the course of manufacture grow into serious defects or causes of defects in service, and to trace their origin and fix the responsibility becomes a lengthy and delicate matter.

Thousands of tons of ingots known definitely to be unsound in the absolute sense are rolled into girders, plates, rails, and other forms, and appear to yield no worse service on that account. Some others break and involve loss of life and other misfortunes as a set-off to the lower costs of manufacture arising from the use of material which is thought to be good enough, but not so good as it could possibly be made. In respect to piping and shrinkage cavities this is accomplished by cropping the top end of an ingot, or by avoiding oxidation of the surfaces of the cavities in order to increase their chances of welding up. To a certain extent this latter aim is secured by bottom-casting, but direct attempts to secure its success have been made in other ways, *e. g.*, inverting the partly solidified ingot.

Individual steelmakers are to be found who contend that bottom-cast ingots can be made perfectly sound in the usual mold by using a long trumpet and feeding it with hot metal. This, on the face of it, is highly improbable, however long the trumpet is made, as the steel in some parts of the runner brick will certainly freeze across, and thus hermetically seal up the ingot before the interior parts of the ingot have solidified. As to volume of shrinkage cavity, there is not a great deal to choose between a bottom-cast and top-cast ingot which have been poured at the same rate; the advantage enjoyed by the former is that its cavities are likely to be sealed from atmospheric oxidation.

If the feeding of a bottom-cast ingot through the trumpet be left out of account and we imagine the mold to have been instantly filled with fluid metal, then it does not matter whether the filling took place from the top or the bottom. The position and size of the shrinkage cavity would be the same in either case, except that with a closed top mold a thicker upper crust would form and there would be small chances of bridges forming beneath it. The first advantage then of bottom-cast ingots is that shrinkage cavities are more likely to be clean and weld up.

The metal rises in the mold more slowly on bottom-casting both on account of the mass of grouped ingots and also because each mold is filled against the pressure of the column of metal in it. The steel freezes through contact with the mold while it is being cast, and at the end of the casting period the solid shell would be thicker, if bled, than the shell of a top-cast ingot of the same size; this is all to the good so far as volume of shrinkage is concerned. Moreover, the ingot is fed under pressure by metal from the trumpet so long as the runner bricks remain open, and this again lessens the volume of shrinkage cavity.

The clean skin expected on ingots cast from the bottom is not always realized. When cast too slowly the ingots are folded on the surface, and when steel is run down the trumpet too quickly to begin with it rises like a fountain through the bottom and splashes the sides of the molds. When cast at average speed the molten metal runs rather sluggishly to begin with along the cold runner bricks, and when first sighted, at the bottom of the mold, appears as a nodule of pasty metal. By pressure from the increasing head of fluid in the trumpet pipe the nodule is forced out of the hole and the metal enters more or less quietly.

Runner bricks are made and laid in the casting plate by human agencies; and sometimes the opening is sloped and sometimes it is chipped or has a fash on one side. Either incident will cause the metal delivered under pressure to be diverted from the vertical, and that part of the mold in direct line with the sloped opening in the runner bricks will be washed by the incoming steel, and may have a cavity melted out of it. This is represented diagrammatically in Fig. 11. The mold is attacked in this manner at varying heights, sometimes as much as 16 in. from its base.

Deflection of hot metal to one side of the mold favors the formation of cracked ingots. This remark ought to be decorated like a recurring decimal when applied to the casting of hard steel ingots. If the

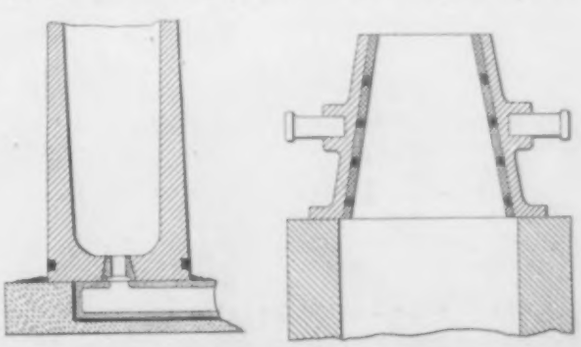


Fig. 12—Detail of Mold Recommended for Bottom Casting and for the Superimposed Feeder Head

runner brick does not open in the axis of the mold the incoming streams cannot possibly form an ingot whose temperature is uniform, and the chances of the surface of the mold being cut are increased.

THE MOST ADVANTAGEOUS METHOD

The most advantageous arrangement, within the authors' experience, for casting groups of ingots is a solid-bottom mold having a central hole provided with a small taper fireclay sleeve as shown in Fig. 12. This arrangement insures the formation and feeding of the

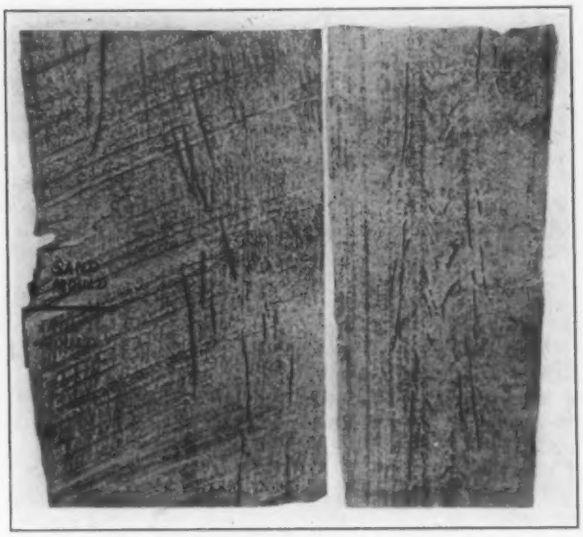


Fig. 13—Sulphur Print (Right) of An Ingot Illustrating Segregates and Ghosts Result (Left) of casting partly in a steel and partly in a sand mold

ingot by a stream of fluid steel entering on and passing up the axis of the mold. The fireclay sleeve is also long enough to give direction to the incoming fluid, and both damaged ingot molds and longitudinal cracks in ingots are practically eliminated. When cast in this manner the mold must necessarily stand with the wide end uppermost.

If we assume a mold to be full of fluid steel at a uniform temperature, then the solid ingot could be sound only if it had been cast with its wide end uppermost. But in all top-cast ingots the fluid occupying the lower part of the mold is colder at the moment casting is finished than is the metal occupying the upper part of the mold, and this to a certain extent depending on the dimensions of the ingot and the speed of casting, is favorable to sound ingots independent of the direction of taper of the mold.

For these and similar reasons it is not permissible to apply rigidly the results of observations made on small ingots with ample taper to much larger ingots cast with so small a taper that they can be stripped only with a machine. Much variation of opinion and a great deal of the recent controversy about sound ingots arise from neglect of this important difference. The difference, however, is one of detail, not one of principle, and the inverted mold should be adopted as the safest means of securing freezing of the ingot from the bottom upwards, whatever may be the size of the ingot.

USE OF THE HOT TOP

As a means of feeding the unavoidable shrinkage cavities in the upper part of an ingot, the simplest and most effective device is the white-hot fireclay head or dozzle used by the crucible steel maker. No feeder-head and no system of producing really sound ingots involve so small a percentage of waste. But the device has not been applied to very large ingots, nor to groups of ingots cast through the bottom from a common runner. A refractory head in the form of a brick lining in the upper part of the mold or, more economically in some cases, as a superimposed piece as indicated in Fig. 12, can be operated with a discard of 10 to 15 per cent of unsound and segregated material.

Apart from shrinkage cavities the inverted mold is advantageous in another important respect. When steel is cast on the cold side, as certain kinds should be to facilitate cogging in the forge or mill without cracking, there forms on the upper surface of the fluid steel a crust of crystals which may be broken and thrown back on the sides of the mold, or pieces thereof may be washed into the ingot and form blow-holes and other centers of weakness. In the ordinary form of mold this frozen surface is being pushed, as the steel rises, into a constantly decreasing area, and it must ultimately break up or allow the steel to flow over it. In the inverted mold, on the other hand, the frozen crust is rising always into a larger area, which keeps its edges free and permits it to grow without becoming thicker and stronger; consequently there is less danger of the crust being broken, and it is possible to produce groups of ingots at a lower casting temperature.

SEGREGATION AND GHOST LINES

The principles of ingot-making already briefly described are applied in the following pages to a few of the problems arising in ordinary works practice. One of the most difficult of these is segregation and the occurrence of ghost lines in large ingots.

If an ingot can be made to consist entirely of long narrow crystals, the segregates are crowded into the center and toward the top of the ingot. But a large ingot could not be made to consist entirely of such crystals, and somewhere between the outside and center of a cross-section there is a more or less clearly defined boundary between crystals growing inward from the outer shell of solid steel, owing to heat conduction, and crystals deposited from the mother liquor whose temperature has fallen to freezing point. This boundary line can often be seen on a well-made sulphur print of common steel.

Talbot has shown, and Neu also at an earlier date, that when the sides of a partially solidified ingot are squeezed together to form a rough bloom, the cross-section of such a bloom shows purer material in the center and outside than on a median area.

By reasoning along similar lines we observe that in very large ingots (such, for example, as are used

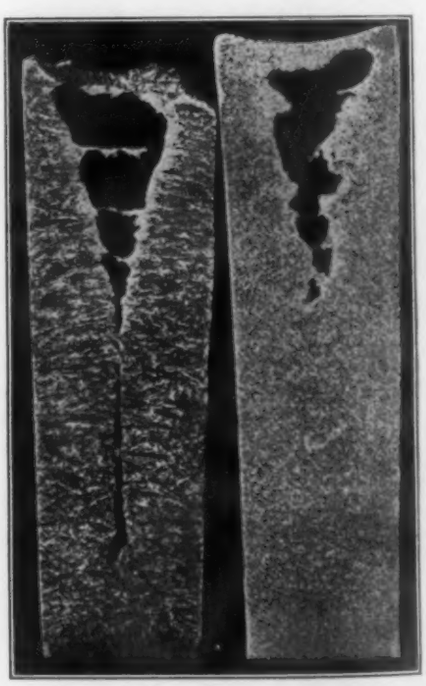


Fig. 14—Relative Shrinkage and Contraction in Hot and Cold Cast Ingots

in making gun tubes) the wall of compact crystals starting from the interior of the mold drives before it, as it thickens, a fluid envelope of impure metal which diffuses readily with the hotter metal nearer the center

as long as both remain quite liquid. When this interior liquid reaches the upper limit of its freezing temperature the more flocculent kind of crystal begins to adhere to the compact walls, and thus restrains somewhat the free movement of the liquid segregate which at that moment occupies the same position.

Unless we are prepared to assume a somewhat violent movement of the interior liquid it must happen that the segregated fluid becomes imprisoned and solidified where the two kinds of crystals meet, and as a matter of fact it is from that position inward that ghosts are found.

By the kindness of Sir William Beardmore we are able to exhibit the sulphur print of a portion of an ingot clearly illustrating segregates or ghosts of the kind referred to (Fig. 13). The explanation given may be confirmed both deductively and by actual observation, but before applying these methods it should be said that the maker of gun tubes first trepans a core from the center of the ingot or from the center of a large billet made from the ingot. He does not care very much whether the discarded core contains ghosts or not, but it is very important commercially to have no ghosts, or as few as possible, on that part of the ingot which will lie ultimately near the bore of the gun.

In a large ingot cast in a loam mold the ghosts were found to be distributed almost to its edge, and it was not possible from any part of the tube to secure test-pieces which would pass inspection. This condition arose obviously from the fact that circumstances were unfavorable to the formation of chill crystals.

As the result of extensive experiment it has been affirmed that much better results are obtained, *i.e.*, there is less trouble with transverse test-pieces cut from a gun forging, when the casting temperature is high. This arises from the fact that a high casting temperature is favorable to the growth of chill crystals; but it may arise also because non-metallic impurities, not strictly due to segregation, have a better chance of escaping to the center and top of the ingot when the casting temperature is high.

Mr. Ashdown has permitted us to refer to a direct experiment made on this subject. He prepared a longitudinal section through a large ingot which was cast partly in an iron mold and partly in a loam mold. The result is shown very clearly in Fig. 13. Mr. Ashdown has allowed us to examine also the results of his many large scale experiments along similar lines, and we were gratified to find them in agreement with our own observations and deduced conclusions.

Other makers of large ingots have been known to affirm that cracks on the corners of such ingots (generally due to high casting temperature) may be taken as a sure sign that the ingot is a good one, *i.e.*, good in respect to freedom from ghosts outside the trepanned core. The effects of high casting temperature in the direction indicated may be admitted, but the remedy is a desperate one, and it may well be asked whether it were not better "to bear the ills we have than fly to those we know not of." If we bear in mind the difficulty of controlling casting temperatures these remarks will suggest, without further comment, why gun ingots made under apparently identical conditions are diversely satisfactory.

EFFECT OF HIGH CASTING TEMPERATURE

The net effect of a high cast temperature is harmful, and it is doubtful whether an exception should be made of gun ingots. It increases the amount of total shrinkage; it increases the number of contraction cavities and intercrystalline cracks (Fig. 14); it adds to the weakness of the ingot along planes which lie between the corners and center of the ingot, and it heightens the danger of clinking in the reheating furnace.

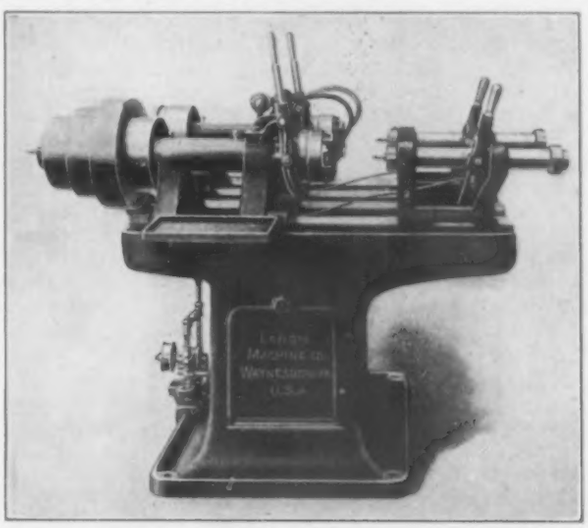
Owing to the higher coefficient of shrinkage of stearine as compared with steel, and its smaller resistance to tensile stresses, it is possible to exaggerate the defects likely to occur in steel ingots. In Fig. 14, for example, a stearine ingot cast in an inverted mold from an unfavorably high temperature is seen to be defective almost to its base. Nothing so visually discomforting as this is likely to occur in a steel ingot, but it is surely an advantage rather than otherwise to have tendencies in the steel we make widened into visible defects in the material used for experimental purposes.

Stearine can be used also to illustrate the general principles of segregation, and to demonstrate some of the causes of spongy and blown ingots. Its value for teaching purposes can hardly be over-estimated.

Hollow Set Screw Threading Machine

The ½-in. double-head bolt cutting machine of the Landis Machine Company, Waynesboro, Pa., is now equipped with special carriages and holding devices for threading hollow safety set screws. While this is the work for which the fixtures were primarily developed, they can also be employed with other stock which can be held in a similar way and has a continuous thread.

The carriages proper are stationary and support two spindles that are free to move in a horizontal plane. Weights attached by chains to the spindle operating levers are relied upon to bring the spindles to the threading die, which is of the builder's standard type, and also to exert a continuous force in that direction, thus making it unnecessary for the operator to advance the stock for the threading operation. The spindle heads are bored and fitted with mandrels to hold the set screws. A collar, which is adjustable for cutting



A Standard Double-Head Threading Machine Equipped with Special Carriages to Produce Hollow Safety Set Screws

any desired length of thread, is located on the rear of each spindle.

In operation the set screw to be threaded is placed upon the mandrel and is automatically forced into the die head by the spindle. When the threading operation is completed, the screw remains in a tube extending through the spindle from the face of the threading die head to the rear of the machine. As subsequent pieces are threaded they pass into the tube and force the previously finished pieces along. When the screw threaded first reaches the end of the tube it is ejected by this action and dropped into a receptacle placed at the rear of the machine.

If desired the machines can also be used for threading standard bolts. When this work is being done, automatic opening and closing attachments are employed for the die heads and the spindle heads are fitted with bolt sockets for the different diameters within the range of the machine.

Large Foreign Demand for Ferrovanadium

Ferrovanadium exports from the United States have reached a total of 1,062,932 lb. for the first eight months of this year and are constantly expanding, as the following table, compiled from Government data, shows:

Period	Total, Pounds	Per Month, Pounds
To Sept. 1, 1916 (eight months)..	1,062,932	132,866
Fiscal year ended June 30, 1916..	1,113,076	92,756
Fiscal year ended June 30, 1915..	755,905	62,992
Fiscal year ended June 30, 1914..	626,641	52,220
Calendar year, 1915.....	840,265	70,022
Calendar year, 1914.....	770,079	64,173
Calendar year, 1913.....	604,287	50,357

While the exports reached over 1,000,000 lb. for the 12 months ended June 30, 1916, they will amount to 1,594,396 lb. for 1916 if maintained at the present rate.

BIDS FOR NEW WARSHIPS

Navy Department Receives Bids for 4 Battleships and 20 Torpedo Boat Destroyers

WASHINGTON, D. C., Oct. 30, 1916.—Notwithstanding the abnormal conditions in the shipbuilding and iron and steel industries, bids within the limits set by Congress in the naval appropriation act were submitted to the Secretary of the Navy Oct. 25 for four battleships, Colorado, Maryland, Washington and West Virginia, and for 20 torpedo boat destroyers, Nos. 75 to 94. The presentation of bids was marked by some novel proposals on the part of two of the shipbuilders, the William Cramp & Sons Ship & Engine Building Company declining to submit a figure, but offering to build a battleship at cost plus a commission of 10 per cent, while the Fore River Shipbuilding Corporation submitted alternate proposals, one conditioned upon the assumption by the Government of any increase in cost due to advances in the price of materials or labor, while in the other the bidder proposed to carry that risk.

The numerous conditions with which the proposals were hedged about, including a unanimous demand from all bidders for a modified form of contract, the changes to be suggested hereafter, and the fact that the proposals submitted will barely take care of the construction offered by the Government, suggests that difficulties may be encountered in placing contracts for the remaining vessels of the big naval program, bids for some of which will be opened Nov. 1 and the remainder in December.

BATTLESHIP BIDS FROM FOUR BUILDERS

Four builders competed for the construction of the four battleships—the New York Shipbuilding Company, Camden, N. J.; Fore River Shipbuilding Corporation, Quincy, Mass.; William Cramp & Sons Ship & Engine Building Company, Philadelphia; and Newport News Shipbuilding & Dry Dock Company, Newport News, Va. The bids ranged from $10,060,000 to $11,475,000, as against the Government's limit for hull and machinery of $11,500,000. In view of the numerous stipulations made by the bidders, it is not practicable to present a reliable forecast of the action of the Secretary of the Navy. Surface indications, however, point to the awarding of one vessel each to the New York Shipbuilding Company, Fore River Shipbuilding Corporation, and Newport News Shipbuilding & Dry Dock Company. The assignment of the fourth vessel is altogether uncertain. The Navy Department cannot entertain the Cramp Company's offer to build one ship on a commission basis, but under the terms of the naval appropriation act it may do so should the proposition be repeated in connection with bids for the four battle cruisers to be opened in December.

Naval experts express disappointment that none of the bidders offered figures for the steam-electric drive system of propulsion preferred by the Department, all offers in this connection providing only for the construction of the ship, the Government to supply the drive machinery and to assume all responsibility for its performance. These offers were approximately $500,000 lower than the figures for all steam drive. In view of the fact that the Department has funds available to complete vessels under the bids submitted, the impression is strong that the electrically driven ships will be ordered.

While regret is expressed by Department officials that none of the bidders was willing to comply with the condition that deliveries be made in 36 months, this was fully anticipated, and the increased time allowance of three or four months is therefore accepted as unavoidable.

THE FORE RIVER'S LETTER WITH ITS BIDS

Present conditions in the shipbuilding industry were impressively described in a letter of the Fore River Shipbuilding Corporation in reference to its minimum bids conditioned upon the assumption by the Government of any increase in the present prices of material labor. This was in part as follows:

Referring to proposals A, both these propositions are made upon the following terms:

This price is based on current prices for labor and material at the yards of the Fore River Shipbuilding Corporation. This company will, upon request, submit them in detail to the Navy Department and to the Federal Trade Commission. If current unit costs of labor and material remain unchanged during the execution of this contract, the exact price for which we are prepared to build any of these ships is as stated. If the costs are exceeded it is proposed that the contract price for the vessels be increased to a corresponding extent. If these costs decrease it is proposed that the Government shall have the benefit of the reduction and that the contract price for the vessels be reduced to a corresponding extent.

The Federal Trade Commission is recognized as the department of the Government organized to deal with all questions pertaining to commercial operations and costs, and it is proposed that the commission shall adjudicate the increases or decreases as above indicated. It is proposed that at the expiration of a year from the date of this contract, and regularly one year thereafter, the commission shall determine the increased or decreased costs of material and labor entering into the construction of the vessels as compared with the original estimates and that the payments for the year under review shall be then adjusted in accordance with the commission's finding. Under this proposal the Government, should it so elect, will be informed in advance of the signing of the contract precisely how the company arrives at its costs and as to the amount of the profit the company expects to earn.

The conditions existing to-day in the shipbuilding industry are unique. In the entire industrial history of the country it has never before been so difficult to forecast the probable cost of labor and material over a period of years. It has been this country's custom to obtain proposals for the maximum amount of materials entering into a vessel, these being held at its option, and available in case it is awarded the contract. Because of the present unprecedented activity in all lines of business, it has not been feasible to cover by option or provisional contract more than 50 per cent of the total material required. The balance must be purchased at different times during the succeeding three or four years. Should prices for material increase during this period as they have in the last 12 months, the cost of the material required for these vessels would be more than double what it is to-day. We do not contemplate such an increase, but the contingency cannot be disregarded.

The second of the two primary elements entering into cost to-day is of an even more unstable character. As we are prepared to show the Department, the total cost of labor that would enter into the building of these battleships has been estimated on the basis of present wages. In ordinary periods of the past, improved methods of construction and additional facilities have offset normal increases in wages, but within the last 12 months wages have risen at such a rate as to show costs in connection with vessels now completing above any figures which could have been expected at the date the contracts were undertaken.

The contemplated profit included in these estimates represents but a fractional part of the margin obtainable to-day in all contracts for the building of merchant ships. Every American shipyard is working at full capacity, and many new companies whose yards are not yet in existence have closed orders at unprecedented prices for all the ships that they hope to build over a period of several years.

Notwithstanding the demands for the construction of merchant vessels, the Fore River Shipbuilding Corporation, fully recognizing the emergency confronting the United States, has for eight months refused all contracts and has reserved a substantial capacity for such work as the Navy Department may desire to allot to it.

The proposals for the battleships were as follows:

BIDS FOR BATTLESHIPS

Class 1.—Hull, electric propelling machinery and equipment, in accordance with Department's plans and specifications.

Class 2.—Hull and equipment in general accordance with Department's plans and specifications, machinery per bidder's design.

New York Shipbuilding Company

Class 2, Parsons geared type of machinery:
1 vessel, 40 months.....$11,350,000
2 vessels, 40 and 46 months, each..... 11,250,000
Pine decking in place of teak, deduct $27,750; if one vessel is fitted as flagship add $37,500; if electric propelling apparatus be furnished by Department, deduct $520,000.

Fore River Shipbuilding Corporation

Proposal A.—Government to furnish electrical propelling machinery, contractor to install it but not guarantee performance.

Class 1:
1 vessel, 42 months, with pine decking.....$10,360,000
2 vessels, 42 and 48 months, with pine decking, each 10,060,000
Class 2—Curtis type steam turbine machinery:
1 vessel, 42 months, with pine decking..... 11,016,000
2 vessels, 42 and 48 months, each..... 10,716,000
If one vessel is fitted as flagship add $40,000; both bids conditional and modified form of contract required; Government to assume risk of increased costs.
Proposal B: Contractor to assume risk of increased cost.
Class 1.—Government to furnish electrical propelling machinery, contractor to install it but not to guarantee performance:
2 vessels, 42 and 48 months, pine decking, each..$10,875,000
Class 2.—Curtis type steam turbine machinery:
2 vessels, 42 and 48 months, pine decking, each. 11,475,000
If one vessel is fitted as flagship add $40,000; modified form of contract required.

William Cramp & Sons Ship & Engine Building Company

No formal bid owing to abnormal conditions of labor and material market, but will build one battleship on cost and commission basis, Government paying all expenses in connection with such construction, including overhead charges, and allowing company additional 10 per cent commission.

Newport News Shipbuilding & Dry Dock Company

Proposal A.—Electric propelling machinery furnished by Department and installed by contractor, Department to run all trials after dock trial.
Class 2:
1 vessel, 39 months.....$10,470,000
2 vessels, 39 and 45 months, each..... 10,375,000
For pine decking deduct $35,000; if one vessel is fitted as flagship add $50,000; certain changes and conditions required.
Proposal B.—Machinery of Parsons or Curtis turbine type of bidder's design furnished and installed by contractor, other conditions as proposal A.
Class 2:
1 vessel, 39 months.....$10,990,000
2 vessels, 39 and 45 months, each..... 10,890,000
For pine decking deduct $35,000; if vessel is fitted as flagship add $50,000; certain changes and conditions required, including modified form of contract; a per cent basis for overtime work submitted with a view to expediting construction.

DESTROYER BIDS FROM FIVE BUILDERS

Competition for the 20 torpedo boat destroyers was limited to five builders—the Bath Iron Works, Bath, Me.; Union Iron Works, San Francisco, Cal.; Fore River Shipbuilding Corporation, Quincy, Mass.; William Cramp & Sons Ship & Engine Building Company, Philadelphia, and Seattle Construction & Dry Dock Company, Seattle, Wash. The bid of the last named was disqualified, being in excess of the appropriation. The bids submitted by the four yards within the limit covered 22 vessels, and awards will therefore be made to all of them.

Class 1.—Department's design.

Class 2.—Hull and equipment Department's design; machinery bidder's design.

Bath Iron Works

Class 2:
2 vessels, 35 knots, 22 and 23 months, each.....$1,185,000
3 vessels, 35 knots, 22, 23 and 24 months, each.. 1,160,000
4 vessels, 35 knots, 22, 23, 24 and 25 months, each 1,150,000
Guarantees of fuel oil consumption at maximum speed instead of horsepower; modified form of contract required.

Fore River Shipbuilding Corporation

Class 1, 27,000 shaft hp.:
4 vessels, 1 in 24 and others in 27 months, each..$1,175,000
6 vessels, 1 in 24 and others in 28½ months, each 1,165,000
8 vessels 1 in 24 and others in 30 months, each. 1,160,000
Modified form of contract required.

Union Iron Works

Class 1, to be built at San Francisco or Alameda, Cal.; 27,000 shaft hp.:
2 vessels, 22 and 23 months, each..... ..$1,195,000
4 vessels, 22, 23, 24 and 25 months, each..... 1,190,000
6 vessels, 22 to 25 months, each..... 1,190,000
8 vessels 22 to 26 months, each..... 1,185,000
These vessels to be duplicates of those covered by Fore River Shipbuilding Corporation proposals, with conditions and data submitted by that company attaching to these bids; modified form of contract required.

William Cramp & Sons Ship & Engine Building Company

Class 1, 27,000 shaft hp.:
2 vessels, 27 and 28 months, each.....$1,195,000
4 vessels, 27, 28, 29 and 30 months, each..... 1,195,000

Seattle Construction & Dry Dock Company

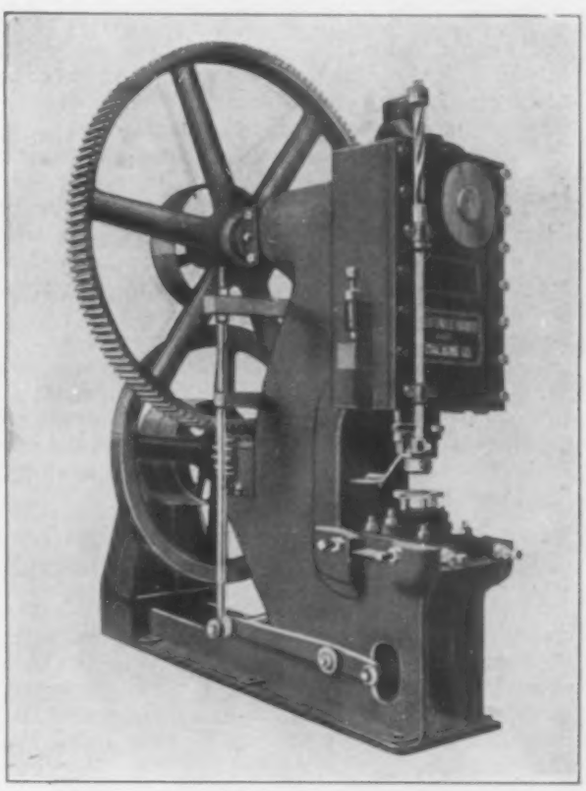
Class 1, 27,000 shaft hp.:
1 vessel, 22 months.....1,386,000
2 vessels, 22 and 22 months, each.....1,370,000
Modified form of contract required.

On Nov. 1 the Department will open bids for four 35-knot scout cruisers and 20 submarines.

W. L. C.

Press for Stamping Washers from Sheets

For making washers and other stamped specialties from either scrap or new sheet and plate material, the Southwark Foundry & Machine Company, Philadelphia, Pa., has developed a line of presses. With this machine it is possible to utilize waste material, which would bring only a small amount



This Press for Making Washers from Scrap Plate Up to 2-In. Bolt Sizes Is Equipped with an Arrangement for Throwing the Washers to One Side as Fast as They Are Made

when sold as scrap, by converting it into washers of either standard or special types. A complete washer is made at each stroke of the ram and the punched washer is thrown out automatically by a special arrangement. As the ram operates continuously, only one man is needed to attend to the machine as he can use both hands to hold the material. In addition to punching out washers the machine can also be used for different classes of stamping, punching, shearing, etc. Various forms of specialty stampings may be turned out, and if desired the press can be equipped with roller feed for automatically handling washer stock in bands or bars.

A single solid casting of the open-gap type is used for the frame and supports the gearing, which is of the single-reduction type except in the case of a motor-driven machine, the plunger, camshafts, dies, etc. The plunger has broad wearing surfaces and is equipped with a bronze taper gib to take up wear. The die for cutting the outside of the washer and the piercer for punching the center hole simultaneously are fastened at the bottom of the plunger. The punch is on the bottom, and is held in a sub-

stantial punch holder block on the lower jaw of the frame. A stripper ring, which is operated from a cam on the back of the main shaft through connecting rods and a lever, surrounds the punch. A series of knockout pins for forcing down the washer, which sticks in the upper part of the die mechanism and ascends with the plunger on its upward stroke, are located in an annular space between the piercer and the die. A bar passing through the ram and stopping against a pair of set screws located in lugs cast on the frame operates the pins.

A vertical shaft having a steep pitch thread at its upper end is located in front and to the left of the ram. The threaded portion passes through a nut at the top of the plunger, which, as it ascends and descends, imparts a rotary motion to the shaft. As the ram ascends, a hand or cup on the lower end of the shaft swings in under the plunger to receive the washer, which has been pulled loose by the action of the knockout pins between the piercer and the die. As the ram descends to make the next washer the cup swings out of the way and throws the washer into a pile or some receptacle that has been provided.

The machine is equipped with a pulley or belt drive or a bracket and the gearing for electric motor drive as may be specified. The back of the main shaft is ordinarily equipped with a tight pulley, which is driven from a belt connection on the lower or flywheel shaft. In this case the machine is operated the same as a flywheel non-geared press for light work, and the flywheel, pinion, shaft and the large gear are removed. When operating in this way it is pointed out that the speed of the press is limited only by the skill of the operator in handling the material.

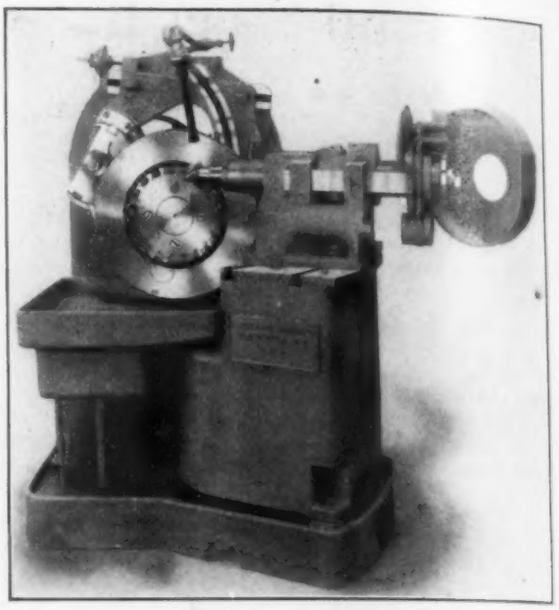
Roughing Machine for Bevel Pinions

The Gleason Works, Rochester, N. Y., has recently developed a machine for roughing spiral type bevel pinions. It is explained that while the builder's standard spiral type bevel gear generating machines will either rough or finish the pinions, it is possible by using the new machine to perform the roughing operation cheaper and faster. The cutter operates at a speed of 130 ft. per minute and one tooth can be cut in as short a time as 19 sec. The pinions, after being roughed on the new machine, are finished on the regular generating machine.

The machine is entirely automatic and will rough either right or left hand spirals. The generating roll of the work spindle actuates a positive indexing mechanism, and for spacing teeth a notched dial with the required number of divisions is employed. The feed, which is of the positive type, is driven by a cam mounted directly on the cutter sleeve. The machine is driven from the countershaft by a belt. The driving pinion for the internal gear drive to the cutter is mounted on this shaft and all the other drives, including that for the pump, are taken from it.

The cutters and the mandrels used with this machine are of the same type as those employed on the finishing machine and, of course, are interchangeable. The adjustments for setting to the spiral angle can be easily and quickly made. The cutter is permanently set to the root angle and, it is pointed out, requires adjustment only as it wears or a new cutter is required. All parts are easily accessible and can be readily oiled and adjusted.

The attachments furnished with the machine include one index dial, a set of feed change gears, a cutter gage, an oil pump and connections, a set of wrenches and a countershaft.



A Universal Machine for Roughing Either Right or Left Hand Bevel Pinions Preliminary to Finishing on a Standard Spiral Type Bevel Gear Generating Machine

The following table gives the principal dimensions and specifications of the machine:

Maximum cone distance of any gear that can be cut, in.	7⅝
Minimum cone distance of any gear that can be cut, in.	0
Longest face in terms of cone diameter	⅓
Maximum ratio of pinion	8 to 1
Largest pitch diameter of 8 to 1 ratio, in.	1⅞
Largest pitch diameter of 2 to 1 ratio, in.	6½
Maximum diametral pitch	2½
Maximum distance from center of machine to spindle nose, in.	12 15/16
Cutter speed per minute, ft.	130
Minimum time for cutting tooth, sec.	19
Maximum time for cutting tooth, sec.	90
Diameter of driving pulley, in.	16
Width of driving belt, in.	4
Diameter of tight and loose pulleys, in.	12
Speed of countershaft, r.p.m.	300
Brown & Sharpe taper of hole in spindle	No. 14
Power required, hp.	5
Floor space, in.	53 x 58
Height, in.	60¾
Net weight, lb.	5,000

New 30-In. Heavy-Duty Engine Lathe

The Houston, Stanwood & Gamble Company, Inc., Cincinnati, Ohio, has placed a 30-in. heavy-duty standard engine lathe on the market. It is of the double back geared type and has a three-step cone pulley. Eighteen spindle speeds, ranging from 8.3 to 300 r.p.m., are available and 24 rates of feed are secured with the regular change gears. By employing additional gears, practically any U. S. standard or metric thread can be obtained, as well as any rate of feed. The tailstock, which is of the set-over type, is clamped by four bolts and is also held in position by a pawl fitting a rack cast in the bed midway between the V's. The lead screw is splined to act as a feed rod, and the apron is of the double-wall type. Any length of bed up to 30 ft. can be supplied, and if desired a housing covering the entire headstock can be furnished to receive the motor for motor drive.

The New York sections of the American Electrochemical Society and the Illuminating Engineering Society have arranged for a joint session to be held at the Engineering Societies Building, 29 West Thirty-ninth Street, New York, on Thursday evening, Nov. 9. An attractive program has been prepared, including papers on "High Pressure Gas Installations," "The Chemistry of Gas Lighting," and "The New Flexible Mantle."

Iron and Steel Institute Honors Judge Gary

The Testimonial a Notable Feature of the St. Louis Meeting—Papers on Duplexing, Iron Ore, Blast Furnace Work and Powdered Coal

Distinction was added to the eleventh general meeting of the American Iron and Steel Institute at St. Louis, Oct. 27, by the paying of a notable tribute to Elbert H. Gary, president of the Institute since its inception, and to the business ethics of which he has been a conspicuous advocate. Important and interesting as was the technical program, the anticipations of the 500 members in attendance focussed in a special way upon Judge Gary, upon the message he had for the Institute in these abnormal times, and upon the testimonial in the tendering of which the entire membership had participated.

The technical sessions of the day were held morning and afternoon at the Planters Hotel. The customary address of the president, to which a particular importance has come to be given, dealt largely with his recent trip to the Orient, printed at length in this issue. Judge Gary gave his impressions of the Philippines, China, Korea and Japan from the standpoint of one seeking with an open mind to interpret all that might interest the American man of business. Prominent among the convictions at which he had arrived was the need in the Philippines for the investment of a large amount of capital which could only be attracted with the islands under the control of a permanent and unassailable government such as he felt circumstances obligated this country to maintain. In China he found a government honest and capable, though as yet lacking the confidence of the whole people; resources of wonderful magnitude promising one day a rich and powerful nation. From Japan he carried away the belief that the controlling influences are as hopeful as are the responsible forces in this country that the relations between the United States and Japan will always be peaceful.

Concerning business conditions, Judge Gary had only a brief comment. He laid emphasis upon the need of a proper tariff to meet conditions that will arise following the war and also upon the necessity that in these abnormal conditions business should be preserved upon a solid foundation, in anticipation of less prosperous times. He spoke as follows:

President Elbert H. Gary's Address

At the last directors' meeting of the Institute, before the summer vacation, a member suggested that at the October meeting I give some account of my proposed visit to the Orient, and therefore he properly may be charged with the responsibility of the president's remarks on this occasion.

I left New York July 3 for Toronto and thence proceeded, via the Canadian Pacific Railroad, to Vancouver; sailed on the Empress of Asia July 13; arrived at Yokohama July 24, and from there went on same steamer to Manila, arriving July 31. I left Manila on another ship (Japanese) Aug. 7 for Hong Kong, overtaking the Empress of Asia, which had preceded the Japanese ship, and sailed for Shanghai. From there I went through portions of China to Mukden, in Manchuria; Seoul, in Korea, and then to Shimonoseki, in Japan, arriving Aug. 29. I remained in Japan until Sept. 14, when I embarked on the Empress of Russia for Victoria, B. C., arriving Sept. 23. I visited the principal cities in Japan and motored considerably through the country, as I also did in China and the Philippines, wherever practicable.

This brief outline has been given because I am hoping many of my hearers will be inclined to inquire into the details and then to personally inspect this fascinating portion of the earth situated on the opposite side of the globe from your habitation. I will later suggest reasons for my wish.

There are many phases of Oriental life and customs, of natural and artificial beauty, of contrasts between the old and new civilizations, all of which attract and interest the student and charm the traveler; but it is not my purpose to attempt at this time to do more than glance at some of the general features of the different countries mentioned, in which, it seems to me, you as business men are especially concerned. Posing only as a member of the business fraternity, I received from foreigners everywhere the most hospitable and generous treatment and the frankest expression of sentiment toward the people of the United States. Also our diplomatic representatives, without exception, were courteous, helpful and hospitable; they are rendering faithful and efficient service.

THE PHILIPPINES

The Philippine Islands, with proper development and modern practice, are capable of supporting comfortably 10 times, or more, the number of people now living within their territory. There can be produced everything indigenous to semi-tropical latitudes and many things to better advantage than on any other lands within the same proximity to the equator. The natural requisites, including moisture, water-power and particularly richness of soil, are all sufficient. The climate is equable and excellent. In the summer it is warm during the middle of the day, but the nights are agreeable. The Filipinos, as a race, are a fine people, intelligent, of good disposition and possessed of capacity for success. I met large numbers of them, confined perhaps to the better educated classes but nevertheless representative. With opportunity, example and precept, they will take a desirable place in the ranks of progressive and worthy citizens.

When the United States, by mere chance, or as the result of an overruling Providence, became responsible for the future welfare of the inhabitants of the islands and for the conditions which might directly and seriously affect other countries, especially those in proximity, there was much in the condition of the people to be deplored. The masses were ignorant; perhaps purposely deprived of education; and they were subjected to tyranny and cruelty. They were poor, unhealthy, diseased, overtaxed and wretched. They were more or less at war with each other and with their government. Every influence, every tendency, was bad. They had no hope for the future.

The United States was a good Samaritan. The splendid men who were duly appointed by our country, including both military and civil representatives, with fortitude and judgment and human instincts took up

and carried on the work of renovating and rejuvenating this conglomerate of physical and moral corruption which had developed without the fault or the understanding of the people themselves. The results of their efforts will stand for all time as a monument to the generous, humane and intelligent policy of an enlightened and unselfish nation, unless something shall be done in the future to counteract or neutralize the results of the course which has been pursued.

Good Work Done by Americans

There has been established a sound and exemplary government. The laws are wisely and justly administered by able and impartial judges; modern and commodious hospitals have been built and are in charge of competent, practical and humane doctors and nurses; plagues and dreadful contagious and infectious diseases have been largely stamped out; model schools, special and common, have been established, and they are filled with eager and industrious Filipinos taught in the English language. Good roads have been built; agriculture, horticulture and forestry have been improved; means and methods for civilization and for modern practical results have been taught, though, of course, much remains to be done.

All this has cost and is costing large sums of money, but emphasis should be given to the fact that, with the exception of the money paid for maintaining the army and navy, which is no more than it would be if stationed elsewhere, the total expense of making the improvements and changes adverted to and maintaining the same, as well as the expenses of administration, including the civil government, courts of law, salaries of appointees of the United States Government, schools, hospitals and everything else of the kind, are, and from the start have been, paid from the treasury of the Philippine Government.

Without the protection and assistance of the United States; without the experienced talent of representatives sent from here; without the added energy, skill and invested capital of Americans; if the Filipinos were again left to themselves they would be unable to make the progress in the development of the resources of the country which is possible and desirable; and the future of the islands would be uncertain. They would not long be permitted to drift toward old conditions so as to be a menace to the health of neighboring nations particularly interested, for the latter would interfere and probably take possession and control.

The United States assumed a moral obligation to the Filipinos and to other nations when she took charge of these islands. She could not shirk it if she wished to do so.

Moreover, if the Filipinos desire it, as I believe they do, and if the United States, as I think a majority of the citizens wish, shall decide to have the Philippine Islands remain permanently a part of the territory of the United States, it would result in great financial benefit to the islands and their inhabitants and also to the United States; and all other nations would approve. Considering the interests of the Filipinos and the Americans both, it would be a grave mistake to sever the relations now existing between them.

CHINA

During the last few decades, at least, China has not kept pace with others in the progressive march of nations. Possessed by nature with extraordinary opportunities, she has nevertheless been retroactive in disposition and, to some extent, has been exploited for the benefit of others. With a population of 400,000,000 and a territory almost as large as Russia, containing the richest and most productive soil, a variety of climate which permits the growth and maturity of the principal grains and fruits, and with an abundance of the richest minerals, she has, notwithstanding, become poor in cash resources; and the normal and necessary development of the country for the proper utilization of the national assets has been neglected, if not ignored.

Apparently, the leading Chinese statesmen, the most intelligent and most influential citizens and the best thinkers are keenly alive to the situation and are earnestly solicitous for the immediate future of China. The present governmental administration and the Parliament as well are devoting their talent and energy to ascertain and apply a solution for the problems which interfere with the growth and strength of their country. They realize that there is needed a new constitution which will establish a concentrated, unified, though democratic, government; a new and modern financial system which will be satisfactory to the financiers throughout the world; an adequate, thoroughly trained and fully equipped military force for defensive purposes; and the adoption of a systematic plan for the development of the whole country for the benefit and for the promotion of the welfare of the whole population. The leaders are frank and outspoken in declaring the desirability of a government such as I have indicated; and they appreciate also the necessity of having the friendship and assistance of all other nations. They know that, under these conditions and with this attitude on their part, and not otherwise, they may expect to establish a credit which will secure the loans necessary to reorganize the affairs of government, and will put to practical use the instrumentalities for providing the money which is now lacking.

Railroads Needed

One of the principal things needed in China is first-class railroads. We know by experience what they are and do for a new country. There are provinces with immense acreages of the most fertile soil and a population of scores of millions that have no pretension of reasonable facilities for getting to purchasing or consuming markets. If there can be established the basis of credit as already suggested, and as now seems probable, it is to be hoped American capitalists will participate in further loans which will permit the rapid extension of railroad lines, for this will tend to correspondingly increase the volume of general business between the two countries.

The people are becoming familiar with the habits and methods of other peoples. They are entering educational institutions in other countries and they are learning the English language. True it is that large numbers in outlying provinces are ignorant concerning the language or ways or even existence of foreigners, but all those in control of national or provincial affairs are well advised and they welcome every opportunity to learn and to assimilate. Especially does China need and desire the sympathy and neighborly support of the people of the United States. Here is a great field for operation on the part of American business men which can be cultivated without injury or objection on the part of any other nation and with decided benefit to China herself. I could wish that in some respects the conditions in the United States which now exist, resulting, I think, from political agitation, might be modified.

The Chinaman is naturally strong, diligent, industrious, economical, honest and intelligent. He is a good farmer and a shrewd merchant. He would like to be a good and loyal citizen, and it is only because he has been imposed upon or has misunderstood the facts that he appears to have been at times unreasonable or disloyal. He is a force in the world that must be considered, and it is wise to influence him honestly and practically in the right direction whenever the opportunity is afforded. Where Chinese blood is mixed with the Hawaiian or Filipino it has raised the standard of intelligent manhood, so far as I have observed.

There are men listening to me who will live to see China a great and prosperous nation; rich, powerful and progressive; better than she ever was in her palmiest days; one of the best creditors of and debtors to other countries; and at peace with all the world. I hope and trust she is just now making a successful start in this direction. I have for her the same kindly feeling which so many of her best people undoubtedly entertain toward the United States. She will some time have the power to do harm, but instead she may be a force for international peace, progress and prosperity.

JAPAN

Japan is a vigorous, progressive, prosperous nation. Representatives have temporarily resided in foreign

countries, including England, Germany and the United States, for the purpose of studying the languages, customs, methods, improvements and facilities for advancement and for defense; and on their reports, from time to time, the Japanese people have adopted and assimilated what they consider to be the best features of enlightened civilization shown in the different countries. They are highly intelligent, determined, adaptable, very industrious and, above everything else, superbly loyal to their emperor and to their nation. The ordinary citizen lives for his country and is just as willing to die for it. There are no internal strifes; on the contrary, there is a harmonious whole. They present to the outside world a united front. This is as it ought to be in every nation. It gives a solidarity of power that is invincible.

It may therefore be seen why Japan has taken a leading position among the nations of the world, contrasting in a striking manner with her place 60 years ago. She has, with Korea, Formosa and other island territory recently acquired, 259,671 square miles and a population of 72,000,000, as compared with 37,000,000 in 1872. Besides all this, she is now increasing in wealth and in the near future will, I believe, be considered rich, unless her present policy shall be abandoned. Her financiers, her business men and her statesmen deservedly rank high. They are farseeing and they are conservative.

I am disposed just now to discuss briefly before you questions which, as a business man, I was free to speak about in my intercourse with Japanese acquaintances. Because I was open and sincere, and especially as I was an American, independent of any political obligation to consider questions of diplomacy, I met willing and attentive listeners and cordial greetings.

Japanese and American Relations

For some time there have been suggestions, in public and in private, in the United States and in Japan as well, that for numerous reasons not necessary to recall there was possibility, if not likelihood, of active hostility between these two countries. Whenever either government has decided to provide an additional warship some one in the other country has been prompt in charging that this meant preparation for war between these two nations.

I said repeatedly, on my own responsibility, making no claim except that I believed I could accurately represent public sentiment, that a large majority of the people of the United States did not desire but would deplore and stubbornly oppose war with Japan, except in self-defense, and that they were of the opinion there is not now, nor will be, any cause for serious trouble or disagreement; that there need be no conflict of opinion which could not be finally and satisfactorily settled by mutual negotiation and consideration. I also expressed the belief that our governmental administration is and would be inclined toward this most desirable exercise of authority. To all this I am sure this large company of representative business men will heartily subscribe.

And now, gentlemen, I am here to say to you in words just as emphatic, and in a belief no less absolute, that the leading and controlling men of Japan are equally anxious to have a continuance, permanently, of the peaceable and friendly relations now existing between these two countries. That there may be exceptions may go without saying; it would be usual, and need excite no surprise nor fear if such is the fact. Still, I have no positive information on which to base this conjecture. I had good opportunity to ascertain the real situation, though my visit to Japan was comparatively short. The most prominent and influential men in Japan are outspoken in their profession of friendship for the United States and her citizens. They refer with satisfaction to the large and increasing trade relations. And, without stopping to enumerate, they speak of our people as their friends and advisers, now and always, as fair and generous and pacificatory in policy and practice; as a model government, whose friendly interest they court.

If you suggest these men may have dealt simply in diplomacy, so called, or in diplomatic language, I answer, they gave me no reason to think so; I secured their confidence as I gave them mine. They do not hesitate to advance the reasons for peace and the objections to trouble. They realize that the geographical locations of these two countries should make them practically allies although acting independently and in their individual capacities and interests. And, from the business standpoint, the Japanese manufacturers, merchants and financiers are desirous of co-operating with those in the United States, to the fullest extent, in protecting and promoting the welfare of both and at the same time benefiting those in other countries with whom both of us may be conducting business. They understand and appreciate the spirit of co-operation which has actuated the men engaged in our lines of business and they would be pleased to consider with us all legitimate plans for the application of this principle. While it is a difficult problem, requiring patience, skill and tact, still I believe we may be able to work out methods which will benefit all concerned. It is well worth trying. International conditions are peculiar. They are complicated and will be worse. Every one interested in international commerce should make careful survey of existing facts for purposes of future explorations and developments. There are many practical problems to consider and their solution will require time and thought; but we will find the Japanese business men ready to take them up in a fair, reasonable and intelligent manner.

BUSINESS MEN SHOULD VISIT THE ORIENT

Now, I would urge all of you, who find it practicable, to visit the Far East. Go during the autumn or early spring months, if convenient, but do not hesitate to make the journey during the summer time. You owe it to yourselves, to the business interests you represent and to your country to come into close relations with the people of these far distant lands.

More and more of our business men should come into close contact with the people of Japan, China and the Philippines. It will be of benefit to all. There is much to see and to learn. Many misunderstandings have arisen and some still exist. They can and should be removed. It is as true as it is old that human nature is about the same the world over. We in the United States are not possessed of all the virtues. We are just as likely to be wrong in judgment and conclusion as others. Indeed, we have often been wrong. If some of our leaders in Congress had been better posted, it is possible that many ill-advised speeches would not have been delivered. At any rate, I strongly urge that as many of our citizens as find it possible take the time to personally and impartially inquire into the facts which bear upon the relations of the United States with other countries. There is always danger of unsettled disagreements if parties conduct their communications at arm's length. If they converse "eye to eye and face to face" even nations are much more likely to avoid conflict and to settle disputes without doing an injustice to any. If we are looking for trouble we can usually find it; and if we are looking for harmony it is, as a rule, equally easy to procure.

If any one connected with our government will spend a few months, or less time, in Japan, with an honest intention and effort to ascertain the sentiment of the large majority of the controlling elements, I verily believe such a one will be convinced Japan is not desirous of trouble with the United States, but, on the contrary, earnestly desires our friendship and co-operation in every worthy ambition.

BUSINESS CONDITIONS

Following my usual custom, I will conclude with a few words regarding business conditions.

It is well known that the steel business in this country is better than ever before. Our concern is only for the future. Many believe there will be a continuance of large business for many months or years after the war closes; others think there will be a material recession. No one can certainly foretell. I have heretofore expressed opinions on the subject which have been published. Obviously the wise man will husband his resources, keep within safe limits and avoid overextension. It is better to be prudent and make less profits than to become reckless or extravagant at the

risk of calamity. With large bank balances we are independent and secure; with large indebtedness to the banks which we could not readily pay we would be in danger of bankruptcy, depending upon future business conditions. All this we know by the experience of the past. As we cannot read the future we should exercise caution and be prepared for unfavorable changes.

Whenever the war shall close, the business of this country will be confronted with new conditions. The purchasing power of the whole world will have been very greatly reduced. Foreign countries that are now buying our products, because compelled, will withdraw their patronage in a large measure. Other non-producing countries will find their financial resources and credits lessened. More than this, foreign producers, in great need, will strive more diligently than ever to supply the countries that are financially able to pay and at prices based upon cheap labor and low cost, as they have a perfect right to do.

Our producers, including our wage earners, will find themselves in commercial antagonism with the most persistent and difficult competition ever experienced, unless this shall be prevented by laws that are reasonable and sufficient. Most of the foreign producing countries, and quite likely all of them, will be thoroughly protected by tariff provisions and we should be on a parity with them in this respect.

I firmly believe, if the present unprotective tariff laws remain unchanged, we shall probably meet with competition from foreign sources after the war closes which will adversely, and perhaps disastrously, affect American industry and American labor. Conditions will be even worse than they were between Oct. 1, 1913, and the beginning of the war.

If the laws shall be amended and adequate protection to American producers and their workmen is afforded, we may expect satisfactory business conditions for some time to come.

Clarence H. Howard's Address of Welcome

Following the presidential address, Clarence E. Howard, president Commonwealth Steel Company, Granite City, Ill., who in large measure was responsible for securing this meeting of the Institute for St. Louis, read a paper descriptive of St. Louis commercially, industrially, socially and in relation to its historical place in the development of iron and steel. Something of the vision Mr. Howard has for St. Louis is indicated in his paper, which is as follows:

My subject, "St. Louis and Its Industries," is an inspiring one, not only because of the present status of our city, but also because of its remarkable opportunities and resources, industrially and otherwise. It seems that the country has come to realize that industrial growth and improvement are inseparable from civic excellence. The investment of some of the fruit of industry in better homes and living conditions, parks, public recreation, etc., is a guarantee of the growth and success of a community, for it indicates recognition of the human element; and, other things being equal, industries will locate where these conditions are the best.

Perhaps no other American city has a more romantic history than St. Louis. It was settled as a trading post in 1764, by Pierre Laclede Liguest, under a grant from the King of France, and was chartered as a city in 1823. It was subsequently under Spanish rule, and on a March day in 1803, when Spain ceded Louisiana back to France, three flags floated over St. Louis: the Spanish colors were lowered in favor of the French, which were immediately replaced by Old Glory. In commemoration of the Louisiana Purchase, which was afterward divided into thirteen States, St. Louis, in 1904, successfully conducted an international exposition which was probably the greatest ever produced. The exposition site covered 1240 acres, partly in beautiful Forest Park, and 250 acres of its area were under roof. The cost, not including individual exhibits, was $42,500,000.

Going further back in our history, it is interesting to know that the forgotten race of Mound Builders chose this community for their remarkable earthworks, which have given St. Louis its side name of Mound City. Archæologists have pronounced these mounds among the very interesting and most ancient works of man.

One of our esteemed fellow members from Rochester recently presented me with a most interesting old volume regarding St. Louis in the early fifties. It sets forth most forcibly the advantages and immense possibilities of St. Louis as the great manufacturing and distributing center of the country. An article regarding railroads indicates some concern in the fifties as to the extent this comparatively new means of transportation would affect the traffic of the waterways. The problem of the country in this respect now seems to be reversed.

ST. LOUIS RANKS FOURTH IN MANUFACTURES

You are probably aware that St. Louis, the metropolis of the Mississippi Valley, ranks fourth in the United States in manufactures, fourth in population, and is located near the center of the country geographically and as to population.

Considering St. Louis from the standpoint of its iron and steel interests, I wish to say that our citizens deeply appreciate the recognition evidenced by the Institute deciding to meet here, this being the first time you have come as far west as the Mississippi River. You will be interested to know that 35 years ago a convention assembling here was welcomed to the City of the Iron Crown, which title was well merited. Iron ore in Missouri was found so pure that much of it was not melted, but was forged directly from the ore. Eighty years ago, in 1836, Featherstonbaugh, the mineral expert of that generation, reported to Congress that Missouri ore was 70 per cent iron, and he stated that a single locality in this State offered iron ore equal to all the resources of Sweden. Another expert, C. A. Zietz, reported in 1837 that horseshoes, knife blades and hatchets were made in blacksmith shops directly from Missouri ore.

Sixty-five years ago you could have seen a man named Palm in a St. Louis foundry building locomotives for use on a railroad west of the Mississippi before there was railroad connection eastward to the Atlantic coast.

Forty years ago the iron-ore production of Missouri was $10,000,000 a year, and it was said and believed that this State had enough ore "to run 100 furnaces 1000 years." To-day the various iron and steel industries in the St. Louis district, which includes both sides of the river, use more than 350,000 tons of pig iron annually, only a small percentage of which is made here. There are still vast mineral resources in Missouri, and within easy reach are the great coal fields of Illinois, and we also have direct connection with the electric power furnished by the great hydroelectric plant at Keokuk dam. At present 60,000 hp. from Keokuk is consumed in St. Louis.

Recognizing the wisdom of diversifying its industries rather than depending upon a few of Missouri's natural resources, St. Louis branched out in various manufacturing lines, of which one result was that while our iron-ore production has decreased in the last few years, our manufacture, consumption and distribution of iron and steel products have enormously increased.

The 26 railroads centering at St. Louis include most of the transcontinental trunk lines, and St. Louis is the headquarters of several of the large systems, such as the Missouri Pacific-Iron Mountain, Wabash, Missouri, Kansas & Texas, St. Louis Southwestern, St. Louis & San Francisco, etc.

St. Louis Union Station and terminals have been pronounced models of efficiency by terminal commis-

sions from other large cities. The tracks of the passenger-train shed accommodate 32 trains side by side, and those tracks have a capacity of 360 80-ft. passenger-train cars. During the year ended June 30, 1916, the Terminal Association handled in and out of Union Station over 105,000 passenger trains and 561,000 passenger cars, and it handled across the Mississippi River 1,216,000 freight cars and interchanged with connections 3,518,000 freight cars. The association employs 4427 people and owns 154 locomotives. Its electro-pneumatic interlocking system, with 344 levers, is the largest in the world.

SOME FIGURES REGARDING ST. LOUIS INDUSTRIES

The iron and steel and allied products of the St. Louis district, based upon official reports, are annually about $80,000,000, including such items as boilers, foundry and machine-shop products, structural iron, stoves, ranges, wire goods, cutlery and tools, agricultural implements, etc. The capacity of the carbuilding plants in St. Louis and adjoining districts makes this the largest railroad and street-car manufacturing center in the country.

The City of the Iron Crown of a third of a century ago has learned to diversify its industries, and has become the center of cheap fuel and of prosperous agriculture. St. Louis iron and steel products are only a part of the total yearly output of its industries. According to Government figures, St. Louis has invested $407,000,000 in 3500 industries, employing 150,000 people, and our total manufactured product is valued at $550,000,000 annually.

SOME THINGS IN WHICH ST. LOUIS LEADS

St. Louis manufactures $65,000,000 worth of shoes annually.

Is the largest shoe distributing center.

Has the largest woodenware house in America.

Is the largest horse and mule market in the world.

Makes more street and railroad cars than any other place.

Leads in the manufacture of stoves, ranges and furnaces.

Holds first place in the output of American-made chemicals.

Is the largest hardwood lumber market of America.

Has the largest hardware house in this country.

Is the largest inland coffee distributing center.

Is the largest fur market in the world.

Another item which will particularly interest the American Iron and Steel Institute is that the St. Louis district's five large cast-steel plants make it the largest open-hearth cast-steel market of its kind in the country. These foundries have a capacity of about 300,000 tons a year of finished product, and consume 1,500,000 tons of raw material.

Technical Papers and Discussions

The program of papers having to do with the practical side of plant operation began with a description of "The Duplex Process of the Lackawanna Steel Company," presented by George B. Waterhouse, metallographist of that company. The paper describes in detail the construction of the plant, the practice in accordance with which the steel is made, and the results that were obtained in the course of 8073 heats. This paper and the discussions presented by Quincy Bent of the Bethlehem Steel Company and Theodore W. Robinson, first vice-president of the Illinois Steel Company, appear on another page.

The afternoon session was opened with a comprehensive paper covering the use of "Pulverized Coal as a Fuel for Metallurgical Furnaces," presented by James W. Fuller, president Fuller Engineering Company, Allentown, Pa. It will be found elsewhere. It was discussed by W. A. James, chief engineer of the Lackawanna Steel Company; N. C. Harrison, general superintendent of the Atlantic Steel Company, and J. P. Kittridge, general manager of the National Malleable Castings Company at Sharon, Pa.

An interesting historical and descriptive paper prepared by Frank S. Witherbee, president of Witherbee, Sherman & Co., regarding "The Iron Ores of the Adirondack Region," was read by L. W. Francis. The extent and nature of the ores of that district were described and the equipment and practice of the mining companies for the treatment of the ore. The paper was illustrated by means of lantern slides. An extended discussion of this ore field was received from J. L. W. Birkinbine of Philadelphia and read by Secretary McCleary. There was also a discussion by F. E. Bachman, of the MacIntyre Iron Company.

Hot-Blast Stove Design

A notable contribution to the literature of the Institute having to do with the blast furnace unit was presented in the paper entitled "Progress in Hot-Blast Stove Design" by Arthur J. Boynton, superintendent of blast furnaces at the National Tube Company, Lorain, Ohio. The factor, as pointed out in Mr. Boynton's paper, which has recently been most influential in directing the progress of hot-blast stove design, is economy of blast furnace gas. Time was when the only conception of the hot-blast stove function was the heating of the air to be introduced into the furnace, without special regard to the amount of gas consumed. The use of gas for power purposes, for the heating of boilers and as a fuel in heating furnaces, places a value upon it which necessitates the most economical operation of the hot-blast stove possible. The general problem now is the securing of high-blast temperatures with a minimum consumption of gas through the more efficient preliminary washing of the gas and the more effective arrangement of the stove checkerwork. As illustrative of the kind of progress that is best serving this end, the paper cites the four-pass hot-blast stove now in operation at the Joliet works of the Illinois Steel Company with its small checkers, and predicts that a reduction in the number of stoves to three promises to be the usual and a very practicable practice. The publication of this paper in detail will come at a later date. The valuable discussion of it, written by R. J. Wysor, blast furnace superintendent at South Bethlehem, Pa., is given below in full:

DISCUSSION BY R. J. WYSOR

Until very recently, as indicated in Mr. Boynton's paper, improvement in hot blast stove design lagged behind progress in construction of the furnace itself. Especially in modern blast furnace plants directly connected with steel works, there is a dual problem confronting the hot blast stove. On the one hand, improved furnace lines and better conditioned stock have permitted the use of higher blast heats. While on the other, the demand for gas for engines and boilers has become increasingly insistent. In brief, the present desired function of the stove is to produce more heat with less gas consumption. To meet this demand, the active co-operation of the combustion engineer and the mechanical engineer is required, the solution requiring both expert theoretical and practical knowledge.

The first half of the problem was solved at Bethlehem years ago by the construction of a battery of five standard three-pass stoves, using washed gas. The hard Eastern and foreign magnetite ores which have always constituted the bulk of our ore mixtures permit the use of the highest blast heats which, practically,

can be attained. Our "straight line" hot blast temperature in normal practice will average well up to 1400 deg. Fahr.

Insulation of Stoves and Blast Mains

The question of insulation of stoves and hot blast system, almost unheard of until about two years ago, is now receiving the attention it deserves. Preventing the loss of 5 to 10 per cent of the heat developed, or what is more to the point, conserving the peaks of the temperature curves, is a strike for efficiency of no small moment. About four years ago we began experimenting at Bethlehem with various materials for hot blast main and stove insulation. At the first opportunity a section of a hot blast main was insulated internally with a special brick, this being one of the earliest, if not the first experiment of the kind, in the country. At a new furnace now being built, the four stoves, stove necks, hot blast main and bustle pipe are being insulated throughout, the stoves, in part with packed diatomaceous earth alone, and in part with insulating brick and insulating earth in the packing space, for direct comparison. The remainder of the hot blast system is insulated with manufactured kieselguhr brick.

Size of Checkers

We are building four of these new stoves of the same three-pass type, with small radial checkers, the minimum checker openings being approximately 4½ in. The heating surface of these stoves will be about 81,000 sq. ft., an increase of over 50 per cent over the old stoves of the same external dimensions. One reason for not attempting still smaller checker openings is the fear of possible clogging of the openings or destruction of the small brick by flue dust in spite of good, primary washers. In our practice, an unusual quantity of fine fume, low in iron oxide but rich in alkali content, is produced, which is imperfectly removed by ordinary wet washers. No comparative amount of such fume is produced anywhere in the West, except in the manufacture of ferromanganese or spiegel. The alkalies in this dust will flux the surface or honeycomb the entire brick, causing its disintegration. The fire clay joints are especially susceptible to attack. The combustion chamber, lower surface of the dome and upper checkers naturally bear the brunt of the action. To prevent this evil as far as possible in the new small checkered stoves, we are installing an improved type of washer, and are using several high temperature alkaline resisting cements instead of fire clay in the hotter parts of the stove.

Air Leakage

Considerable attention is also being paid to the prevention of air leakage in old and new stoves. The vulnerable points in a stove and connections for escape of air blast are many and likely to be forgotten. Too much attention cannot be given to the bottom construction, as leakage there is of an insidious nature and may not be discovered for a long time. The blast may escape through a crack or burnt bottom plate if not water-cooled, or around the outer edge of the angles, riveted to the bottom plate, and around the lower ring of the shell, if weak, or if the calking has been improperly done. Stove-riveting should be a fine art, as leakage can often be detected around the rivet heads and good calking or lapped edges is necessary. Clean-out doors require occasional attention. Blast leakage through cold blast, hot blast and chimney valves at times may be of unbelievable magnitude. Improvements in the construction of these valves, especially the chimney valve for the three-pass stove, which will insure perfect heating at all times, will be a boon to the blast-furnace fraternity.

Mr. Boynton states that there is as yet no general tendency toward the use of forced draft for air or gas. It is my present opinion that for our conditions at least, it is equally satisfactory and much less expensive to have an expert continually to look after stove efficiencies, and who will supervise the stove tenders, than it is to employ more or less self-regulating induced pressure burners. We are now practising this belief.

The Banquet and Testimonial to Judge Gary

In the attractive banquet room of the Missouri Athletic Association about 700 members and guests gathered for the usual banquet. It took its character almost wholly from the acknowledgment of the services of Judge Gary in making co-operation and fair dealing a part of the business practice in the American iron and steel industry and from paying a personal tribute to him as the force that had made the Institute so great a success. Following the manner of previous banquets, the chairman called for impromptu talks from various members. George W. Simmons, vice-president of the Simmons Hardware Company, St. Louis, spoke concerning the greatness of St. Louis's future; W. A. Rogers of Rogers, Brown & Co., gave a reminiscence of his early pig-iron selling experiences at St. Louis, and E. F. Kearney, president of the Wabash Railroad, spoke eloquently of the need of appreciating one of the great truths of industry—the dignity of honest toil. Judge Gary also called upon John C. Schmidt, president of the Standard Chain Company, who spoke at length regarding industrial preparedness. George B. Early, of the American Sheet & Tin Plate Company, injected a humorous debate as to the relative importance of the heart and liver in the affairs of man, and James H. Hoyt indicated some of the unsuspected virtues of the legal profession in its relation to business.

THE PRESENTATION

President Schwab of the Bethlehem Steel Company, to whom had been accorded the distinction of representing the Institute in the presentation of its testimonial to Judge Gary, then spoke briefly, saying that no other man in the association or in the iron and steel business could have carried through the Institute project as Judge Gary has done and that no one could admire the spirit of fairness and co-operation in which Judge Gary had always acted more than did he. The gift presented to Judge Gary was a solid gold inkstand and pens.

The nature of the gift had been a secret with the committee appointed for its selection and not until just before the banquet was Judge Gary made aware that some form of testimonial was on the program. In rising to accept the gift, he acknowledged that he was not entirely unaware that this expression of regard was to be made, and that without such warning he could not have trusted himself to make reply. There was much he had in his heart to say, but he had felt constrained to set down in prepared form some of the things for which the occasion called. He then said:

I realize your sentiment extends beyond and above personalities. I happen to be prominently connected with the endeavor to apply the principle of co-operation, in the highest sense, to our practical, everyday business life.

BEGINNING OF THE CO-OPERATIVE MOVEMENT

In the autumn of 1907 the clouds of uncertainty loomed big and black on the business horizon. We were all more or less dependent and this feeling was not confined to our industry. The experiences of the past had been a forceful teacher. Leading men in financial and commercial circles implored those connected with the "barometer of trade" to use their influence and efforts toward diverting and dissipating the impending financial typhoon.

I take this opportunity to emphasize the fact that

no one directly connected with the Gary dinners, so-called, ever did or ever would do or say or approve anything concerning our business that is opposed to the spirit of the law or to the general public sentiment.

Now, what is this principle of co-operation? It is an honest, earnest effort to secure and maintain among business rivals a fair, healthy, vigorous competition and at the same time to oppose and to prevent an unfair, oppressive, cut-throat and destructive competition. It is calculated to establish on the one hand and to avoid on the other hand the very things so clearly and emphatically directed in the discussions of the Supreme Court of the United States. Summed up, it is described in the old expression: "Live and Let Live."

In 1907 and the months following, our conservative, open, neighborly attitude no doubt acted as a stabilizer and aided in the prevention of sudden and extreme fluctuations that would have disorganized and demoralized business to the prejudice of large numbers of both employees and employers; and purchasers, with large stocks on hand, as well. We have an abundance of testimony to this effect from our customers. It also created and fixed in our minds the sentiment that rivals in trade may at all times be considerate and solicitous concerning each other. That there is something substantial in the idea of mutual confidence and regard, even in competitive business circles, we see abundance of proof on this occasion.

SUPERVISION OF FEDERAL TRADE COMMISSION

It is probable the Federal Trade Commission may be of much benefit to business men, depending upon the disposition of its members. So far as we have had opportunity to observe, this commission is favorable to business success. I would like to have its authority enlarged so as to permit it to advise in advance if inquiry should be made as to a contemplated action; but even under present conditions the commission should be of real service. I do not believe in governmental paternalism or management; but I do approve of governmental supervision and I favor patriotic, intelligent, generous operations by private individuals—in co-operation between officials and private interests.

Continuing to preside, Mr. Schwab called upon Robert Hobson, president Steel Company of Canada; James A. Farrell; Cameron C. Smith, president Union Steel Casting Company, Pittsburgh, and Willis King, all of whom voiced their admiration of the qualities and the policies which had made Judge Gary so essential to the iron and steel industry in the past ten years.

More effective perhaps than anything else that was said, were the closing extemporaneous words of Judge Gary himself. With great feeling he spoke of the way in which both the testimonial and the expressions of regard would be cherished, not because he had deserved them, but to mark the fact that one man could so win the confidence of his associates.

Excursion in St. Louis District

Saturday was spent by the officers and members of the Institute in a tour of inspection of the railroad yards and terminals on both sides of the Mississippi and of the St. Louis industrial district, particularly those sections devoted to or eligible for iron and steel operations. Boarding a special train at the Union Station at 10 a. m., the party which filled ten coaches spent four hours on the trip and in a luncheon stop at the Commonwealth Steel Company's plant at Granite City, Ill. At all the iron and steel plants passed by the train the employees "dressed out" in the yards to salute the party, while flag decorations and continuous whistle salutes added to the evidence of interest in the inspection. At the St. Louis Screw Company's plant on the west side of the river, which was reached after lunch the employees remained two hours over time to greet the visitors. This plant, too, was handsomely decorated in the national colors.

At the Commonwealth Steel Company's plant the visitors were conducted through every department by special escort committees of employees after which lunch was had in the restaurant which the company maintains for its force. Following the lunch Judge Gary made a short talk to the assembled force, complimenting the men as well as the conditions under which they work. He referred particularly to the Commonwealth Fellowship Club of officers and employees and the safety-first work done in the plant, which has reduced its annual accident costs by $30,000 to $50,000.

Arriving at the detraining point on the west side of the river at 2 p. m. the party was taken on an automobile tour of the residence and park districts of St. Louis and also into the country suburban district which included a stop for refreshments at the old Grant farm, now the suburban residence of August A. Busch.

Most of the members of the Institute departed from St. Louis on the Saturday evening trains and the remainder on Sunday.

Duplex Process of Lackawanna Steel Company

BY GEORGE B. WATERHOUSE*

THE duplex process is commonly understood as a combination of the acid Bessemer and the basic open-hearth processes. The tonnage of steel ingots made by this process has very rapidly increased during the last five or six years.

DESCRIPTION OF PLANT

The acid Bessemer department was already in existence when duplexing was decided upon by the Lackawanna Steel Company. It contained two mixers of 250 and 300 tons capacity respectively, four 12-ton converters and 12 cupolas. Eight of these were for melting iron, and four smaller ones for melting the spiegel mixture used when making rail or high-carbon steel. After careful consideration of the various possible locations, the open-hearth was placed directly north of the old Bessemer plant. Two large tilting furnaces were built. This arrangement makes a comparatively short haul for the blown metal between the converters and the open-hearth furnaces. The iron cupolas Nos. 1, 2 and 3, nearest to the open-hearth, were remodeled for the melting of spiegel mixture, and a scale was installed opposite No. 2. Since then cupola No. 4 has also been altered for the same purpose, and, like the other three, it taps into a ladle standing on the same scale. The transfer track for the blown metal extends far enough into the Bessemer plant so that all four vessels can be used to blow metal for duplexing.

The open-hearth plant is very massive and strong. Extremely heavy construction has been used for the building, furnaces, and machinery, in order to insure as far as possible against delays or shut downs due to breakage. The building, housing the two tilting furnaces, is of steel throughout and is 352 ft. long by 124 ft. wide. It has since been enlarged to take care of eight stationary 100-ton furnaces, and is now 1038 ft. 2 in. long by 124 ft. wide. The massive construction is particularly noticeable in the case of the crane runway girders, which have a length of 110 ft., a depth

*Metallographist of the Lackawanna Steel Company, Buffalo, N. Y.

of 12 ft., and weigh about 115 tons each. The extreme length is necessary in order to span the tilting furnaces, which are themselves very long and which are placed along the line of the center columns of the building. The crane runway girders are protected, over the furnace proper, by steel shields suspended below the bottom chords.

The metal from the Bessemer plant is brought in the transfer ladle to the open-hearth plant. It is hoisted to the charging floor level by a crane of 75 tons capacity, having an auxiliary trolley of 25 tons. The span is 55 ft. 10 in. For handling the cold material there is a high-type charging machine. The pit side is served by two 165-ton cranes of 58 ft. 8 in. span, each with an auxiliary trolley of 35 tons capacity. These 35-ton trolleys are also equipped with a 5-ton auxiliary hoist, which is used for tilting the spiegel ladle.

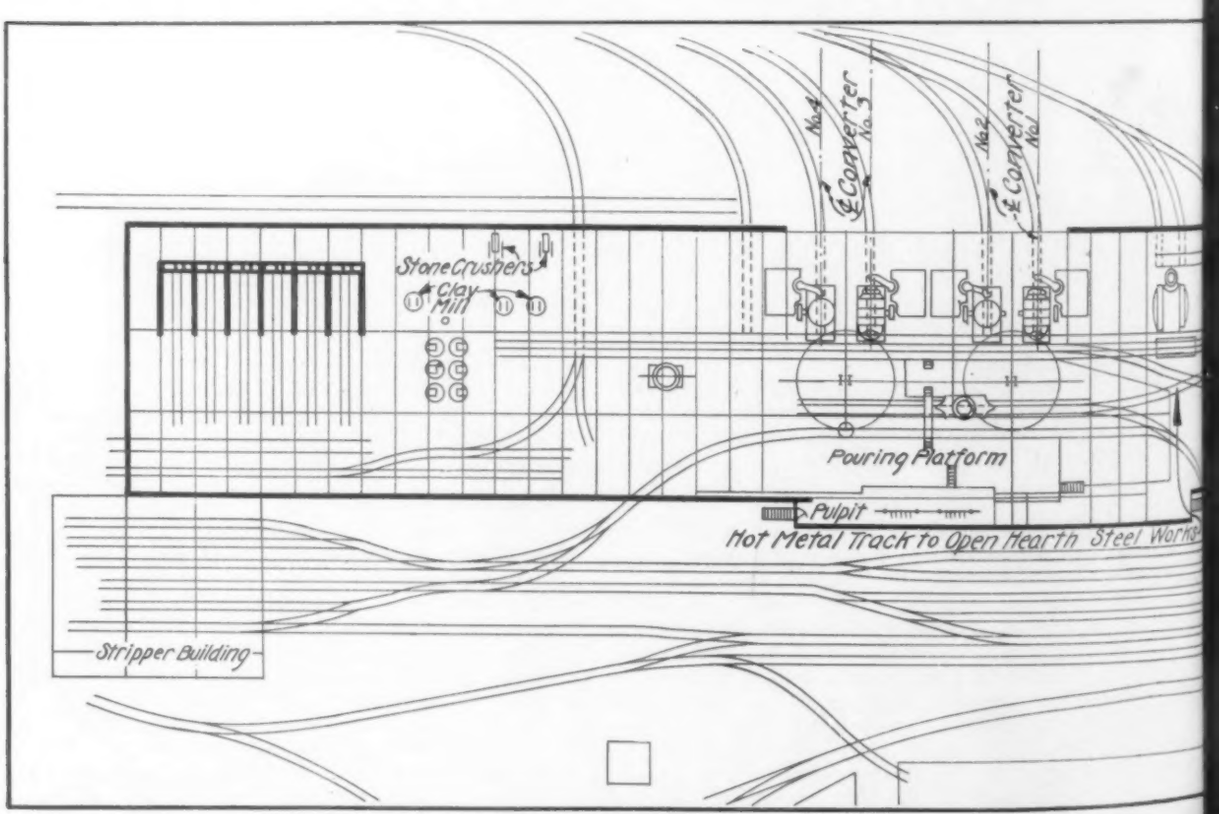
Above the pouring platform is the track along which the spiegel ladle comes from the cupolas. The elevation of this track above the floor level saves valuable floor space. The roof trusses span the entire width of the building, so that no roof load is carried on the center columns or the crane girders, and vibration is not communicated to the roof. A platform for the convenience and safety of the crane operators is provided along the entire side of the building. This platform is level with the floor of the operator's cage, so that he can step directly from the cage to the platform at any point along the runway. The ventilation feature is rather simple, consisting of the usual louvre type of monitor so frequent on mill buildings. Its size is greater than the average. The width is 41 ft. and the height 12 ft. from the base of the posts to the bottom chord of the truss.

In common with the rest of the plant the furnaces were designed and built by the Lackawanna Steel Company, and are of massive construction. The framework consists of heavy beams and channels, suitably tied together and braced. This framework rests upon two heavy box girders, and extending from one rocker casting to the other. These castings are set 30 ft. 6 in., center to center, and rest on heavy I-beam girders, which support the entire weight of the tilting portion of the furnace, including the bath of metal. The girders also form a part of the tilting mechanism and are supported on a series of steel rollers mounted in a massive base casting.

The tilting or rotation of the furnace is accomplished by means of a rack bolted on the I-beam girders, which meshes with a gear segment bolted to the rocker castings. The rack is moved by a steel screw journaled between the I-beams, and held by self-aligning thrust bearings of the ball-type, so that no lengthwise motion of the screw can take place. The screws, one for each I-beam girder, are each driven by a 50 hp. motor, and are cross connected by shafting below the floor level in order to insure equal movement of each rocker casting, and avoid harmful twisting stresses in the structure and brickwork of the furnace. The furnace may be tilted in either direction, the extremes being 38 deg. travel from the vertical when pouring, and 15 deg. travel toward the charging side when removing slag. The center line of the ports has been made the center of rotation of the furnace, which results in the stationary ports and those in the tilting portion of the furnace always maintaining their proper relation to each other. Cold air is prevented from striking the ports or entering the furnace.

Each furnace has a hearth 13 ft. wide by 40 ft. long, and is 50 ft. long over the chill plates. On the charging side there are seven doors. At the center of the furnace there is a door 2 ft. 6 in. by 2 ft. 11 in. On each side are two doors 3 ft. by 3 ft. 6 in., those next to the center being equipped with a tapping spout. Also on each side there is a smaller door, near the ports, 2 ft. by 2 ft. 4 in. Blair water-cooled ports are used, and great care has been used in the construction of the ports so that when the furnace is heated up there is a minimum of clearance between the stationary ports and the tilting part of the furnace, greatly reducing the amount of cold air entering the furnace. The slag pockets and regenerator chambers are of ample proportions, and the binding is unusually heavy and well tied together. The checker volume for each end of the furnace is 5388 and 3084 cu. ft. for air and gas, respectively.

For each furnace there is a self-supporting steel stack, 180 ft. high, and 7 ft. diameter inside the lining. The gas and air reversing valves are water-cooled and water-sealed, and of the same design as used on all the Lackawanna Steel Company furnaces. They are



RELATION OF THE BESSEMER CONVERTERS AND OPEN-HEAR

36-in. diameter for the gas, and 48-in. diameter for the air. The fuel for the furnaces is furnished by Hughes self-cleansing mechanical producers, four for each furnace.

DESCRIPTION OF PROCESS

The process may be said to last for a week, for each week-end the tilting furnace is thoroughly drained, the bottom and slag line made up, the ports cleaned and repaired, and everything made ready for the week's campaign. About 6 p. m. Sunday, the gas being once more on the furnace after burning out the flues, the work of preparing the slag is begun. Four boxes of burnt lime and three of roll scale are charged and melted down. These amounts are then repeated, and when again molten the same amounts are again charged, the total being 12 boxes of lime, and 8 to 9 boxes of roll scale. The average weight of a box of burnt lime is 2000 lb. and of a box of roll scale 3000 lb. Considerable care is given by the melter to the preparation of a good slag, for the success of the process (as in all open-hearth work) depends on the slag. At midnight, or shortly afterwards, the metal is ordered from the Bessemer department. An average analysis of the mixer metal is:

	Per Cent
Total carbon	0.370
Silicon	1.50
Manganese	0.65
Sulphur	0.045
Phosphorus	0.360

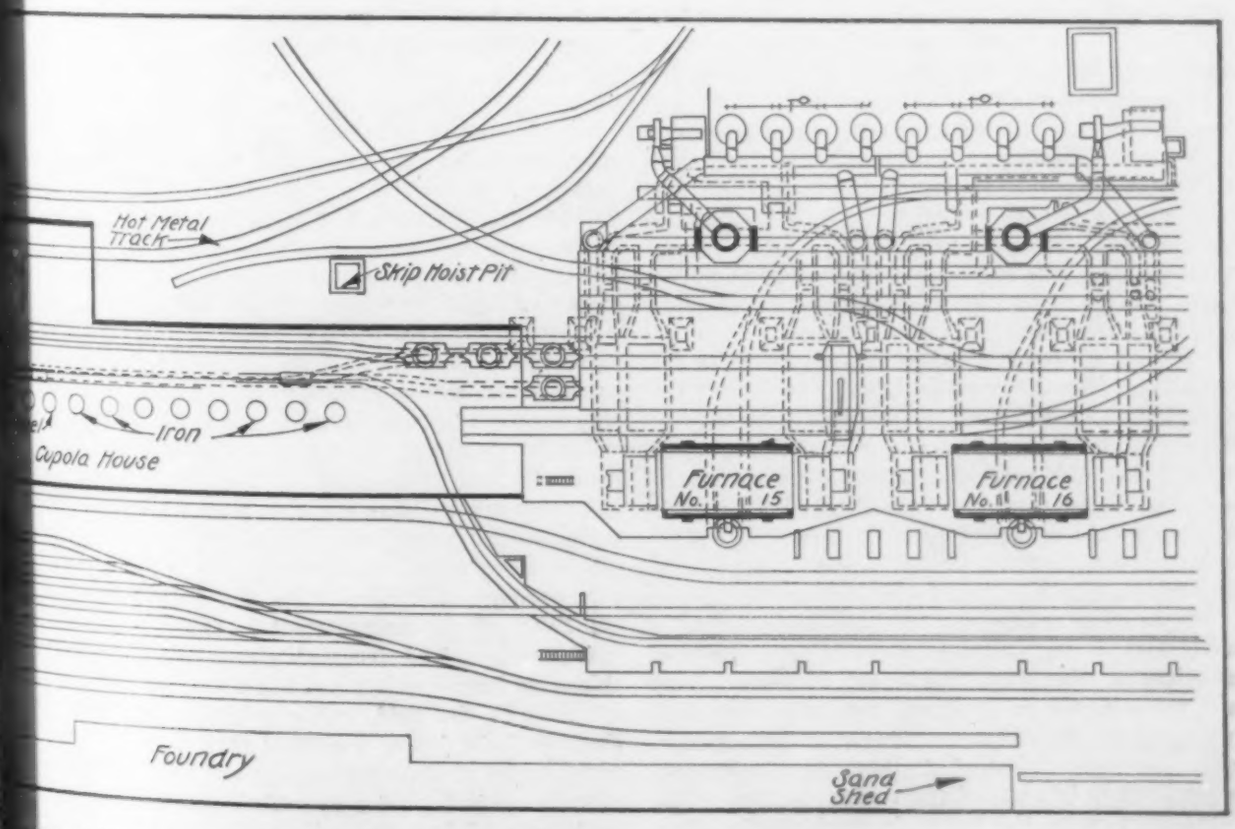
The weight of this metal taken for a Bessemer heat is 28,200 lb., less the weight of scrap used in the converter. Two Bessemer heats, blown in different vessels, are poured into the transfer ladle and taken to the tilting furnaces. When starting up, the first ladle contains metal blown down to about 0.40 per cent. carbon, to give a little action in the furnace. This first ladle is poured into the open-hearth furnace about 12.45 a. m. It is followed by two ladles of "soft" metal, that is metal blown down to 0.05 per cent to 0.07 per cent carbon, and then by a "high" ladle, or a "kicker." This ladle contains metal blown down to 1.5 per cent to 2.0 per cent carbon, and when it is charged into the open-hearth there is a vigorous reaction. The metal and slag are thoroughly mixed together, and during this reaction the phosphorus is largely removed from the metal bath to the slag. When this reaction has subsided, two more "soft" ladles and a "high" are charged. Then, if the bath is found to be low in carbon, another "high" ladle is given; while if high in carbon another "soft" ladle is charged. In this way a bath of metal of 190 to 200 tons is produced. The charge is then worked down like an ordinary basic open-hearth heat until ready for tapping, which is usually at about 3.30 a. m.

After the heat is tapped there is a bath of about 100 tons of metal with 0.15 per cent carbon still in the furnace, covered with the tapping slag. Two boxes of lime and two boxes of scale are charged, and burnt dolomite used along the slag line, around the doors, etc., as found necessary. Then three "soft" ladles of blown metal are charged, and two more boxes of lime, followed by the "high" ladle or "kicker." During the reaction the furnace is tilted slightly forward and slag allowed to flow from the front of the furnace through the slag spouts. As mentioned before, these are under the doors directly on each side of the center door. The slag falls into the slag cars standing on the tracks. Practically all the slag taken from the furnace is removed in this way, for when tapping a heat only enough is taken to properly cover the metal in the ladle. When the reaction is over, another box of lime is generally charged and the bath worked in the usual way. Very often another box of lime is spread over the slag shortly before tapping, so that five to six boxes of lime are used per heat, but as a rule only the two boxes of scale.

After the heat is tapped this procedure is repeated, enough slag being taken from the front of the furnace, at the time of the reaction, to maintain a constant and proper volume of slag in the furnace. A typical analysis of this slag, together with that of the other materials is given in Tables 1 and 2. The average time from tapping one heat to tapping the next, for 8073 heats, was 2 hr. 53 min.

About 80 per cent of the steel made in the tilting furnaces is recarburized in the ladle with molten spiegel mixture. The rest is made with the usual additions of ferromanganese, ferrosilicon, etc. When the bath is ready for tapping the tap hole is opened and plugged

(*Continued on page* 1035)



...ES IN DUPLEXING AT LACKAWANNA STEEL PLANT

ESTABLISHED 1855

THE IRON AGE

EDITORS:
A. I. FINDLEY
GEO. W. COPE W. W. MACON
CHARLES S. BAUR, *Advertising Manager*

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The Fuel Famine

The supply of coal for domestic consumption is menaced in two ways—by the extremely high prices certain consumers are able and willing to bid for spot shipment and the delays in transit in the case of long hauls. The country is made up chiefly of common people, as Abraham Lincoln once suggested, and even when coal is cheap the majority of them are forced to economize more or less in its consumption. When steel mills making $25 to $50 a ton on their product find themselves short they can and naturally will bid prices for coal which the common people cannot consider. They are simply outbid. The distribution of coal to the ordinary consumer requires when everything is working smoothly that a very large tonnage be in transit and in storage. When there is any slowing down in the movement, the volume in transit must be increased or the receipts at final destination fall off. The current requirements of the country in coal amount to about 2,000,000 net tons per working day. Much is consumed at or near the place of production. If we assume for one-half the tonnage an average haul of ten days, when the railroads are working smoothly, then there is normally 10,000,000 tons in transit. If the average movement lengthens to 20 days a shortage is produced at destination of 10,000,000 tons, even though precisely the same tonnage may be shipped day by day, as could not be the case with a decreasing return of cars to mines. Thus the supply to the consumer is menaced in two ways—by the high bids made by some consumers and the extra coal locked up in transit.

There has been a shortage in coal production for some time. The ultimate consumer has not felt the shortage as he will later unless conditions are relieved; for it is normal for stocks to be accumulated at this time at distribution points and those stocks are much below what they should be. The pinch is not felt by the consumer as much now as it will be when the normal time arrives for the stocks to be distributed and it is found that they are not there.

Some relief is expected when the season of Lake navigation closes, because normally coal becomes plentiful at that time. These are abnormal times and the supplies released will not make the usual impress upon the situation. There is, furthermore, such congestion at lower Lake ports that the amount of coal yet to be shipped from mine, in hope of its being shipped up the Lakes, is much smaller than usual at this time. Such a shortage is predicted for the Northwest, moreover, that all-rail shipments will probably have to be made in the winter from Illinois and Indiana mines, thus further restricting the relief that the end of the Lake shipping season should bring. Altogether the situation as to coal is a very serious one.

Machine Tools and the Future

Efforts to peer into the future and arrive at some conclusion as to conditions which the builders and sellers of machine tools must face after the war are naturally growing more intensive as time wears on. Several speakers and contributors of papers at the recent meeting in New York of the machine-tool dealers devoted attention to this subject.

Despite the oft-made assertion that the tools ultimately to be discarded from temporary munitions plants will be worthless, or nearly so, because of the forcing and rough handling they have received, it was admitted that large numbers of usable tools will find their way to the second-hand market, one dealer asserting that he knew of $750,000 worth of such machinery. A list of miscellaneous new tools valued at approximately $1,500,000 is being circulated in the New York market. An advertisement offers for sale a complete plant for manufacturing 3.3-in. British high explosive shells—tools, motors, line shafting and all accessories, and it is well-known that many munitions makers have been offering for some weeks tools which they no longer need.

Not only will the manufacturers have to contend, when peace conditions arrive, with the certainty of an abnormal volume of used machines, but also with the offerings by new makers, not a few of whom will fight vigorously to remain in the business. The statement was made at the meeting that probably 100 firms are building machine tools who were not doing so two years ago. Some of these, undoubtedly a majority, will not stick. Many lathe makers, who engaged in the line when the demand was at full flood, admit their pursuit in this direction is but passing. The frenzied search for such machines no longer exists, yet not a few new makers are still in the field, and experience is teaching them to build better machines than they built at first. Some of these newcomers not only intend to compete with the older manufacturers in lines already entered, but are seeking other types of tools

to build. In a few cases they probably will compete with builders for whom they are now manufacturing.

When the question has arisen as to how far the German manufacturer will suffer from prejudice and clinging animosities after the war, German business men marooned in this country have found much solace in the contention that they will get business in satisfactory volume if they make their prices attractive. At the dealers' meeting something of the same sentiment with regard to the domestic situation was manifest in the discussion as to how sellers of new and standard tools can successfully compete with new tools of cheap construction, as well as with second-hand machines. A favorable factor in overcoming the latter is that most buyers prefer a new machine tool, as they do a new automobile, if the difference in price is not too great. An unnamed manufacturer of tools was quoted as saying that he contemplated, at the psychological moment, a cut in prices which would be stimulating to the domestic buyer. How he would determine the propitious moment was not stated. The consensus of opinion among dealers seemed to be that the future will revolve around the prices of new machines. These at present are strong; in fact, advances are comparatively recent, and prices are not likely to recede soon, in view of the high and advancing cost of raw material and the higher wages which the times demand.

So far, the trade has suffered but little from cancellations, because of the genuine nature of the demand, the abundance of money and careful selling, substantial deposits being exacted with the order in many cases. At the same time the generous sentiments of leading dealers with regard to cancellations will commend themselves to broad-minded manufacturers. Without any suggestion of letting down the bars, the thought was expressed that the ties between manufacturer and dealer and between dealer and buyer are more or less continuous. Their interests are interdependent, and a share of the courtesy passed to the dealer by the builder must go to the buyer. It was pointed out that "if an extreme and unusual change in business occurs" it is not reasonable to expect that no orders for new equipment would be canceled, nor would it be for the best interests of all concerned if orders were made absolutely non-cancelable. The remedy would seem to be in continued careful inspection of orders in their incipiency, with early pains taken to learn how earnestly the buyer wants the machine he has ordered, as one member suggested. Tempering justice with mercy still holds good.

It is certain that a most careful and studious diagnosis of the trend of trade from now on is indicated as a vital policy, also that each member of the industry should pilot his business even more carefully than heretofore, to be prepared for possible shocks to the prosperity still to come.

Need of Fatigue Studies

Industrial fatigue is a problem in shop management which has not been given the serious attention it deserves. Now and then a bit of evidence is produced, commonly not much more than an observation, to prove the wisdom of a periodic rest interval, but beyond such bolstering of the wide belief that there is something in the claim of overfatigue no specific method of relief is forthcoming ready for application in a given plant. So far it is tacitly assumed that the college or the private laboratory should do the investigating. Without specially provided funds, with many other lines of research offering, the laboratory does not pursue a thorough and conclusive study. It remains for the endowed institution to do it, such as the Engineering Foundation, perhaps, or one concerning itself with health conservation, or a manufacturers' association covering a single industry, which may find recompense for raising the money through increased output per unit of wages.

It is not that industry, under present conditions, jeopardizes health, but that continuous employment, especially under piecework and bonus incentives, is not conducive to maximum production. Neither the industry nor the worker gets what is due under conditions that do not properly allow for the fatigue factor. Rates based on time studies make such an allowance, but ordinarily the operating régime does not, and this latter fact makes the allowance not much more than an arbitrary factor of safety.

In Great Britain, the subject has been studied ever since so many of its establishments—4319 at this writing—were put under government control. There the necessity grew out of the lengthened workday and the intensive production war demands entailed. So-called monotonous repetition operations and jobs requiring varied applications of handicraft and headwork are differentiated. So far, two reports have been published, and from brief summaries of their findings it is clear they will prove notable additions to the meager literature now available. Whether it will be possible, for example, to deduce from the results what is the best interval to be taken between rest periods for different classes of machine operators, and what is the proper time limit of the rest period itself, or, indeed, how such rest periods can be provided for, cannot yet be known, but what does come out ought to be a good guide for the investigations needed in this country.

Contracts and Deliveries

Never have producers of iron and steel had so many delicate questions to settle as to what is right in allotting deliveries to their customers. In ordinary affairs the distinction between what is right and what is wrong is supposed to be quite clearly defined, but when mills are behind in deliveries there is simply a choice of evils. The ambition of the average steel maker is to allot the deliveries so that all customers will be equally served, that such inconvenience as must be suffered shall be equally distributed. The steel maker, however, is not omniscient, and some consumers of steel can paint a more lurid picture of their sufferings than can others. Even if the steel maker were a mind reader he would not be able to arrange a distribution of his products that would cause the least total inconvenience among his customers, for hardships make a more serious impression upon the minds of some buyers than upon the minds of others.

Nor would a distribution of steel that minimized the sum total inconvenience of the group of

customers be satisfactory to all. Among the customers are naturally some whose material is more overdue than is the case with others and those customers are indisposed to consider the inconveniences of others. Their contracts call for the delivery of the material and they stand squarely on their contracts, no matter what may happen to others. It is among such buyers that the charge usually arises that the mill is delivering the high-priced material at the expense of the lower-priced contracts.

One cause of the difficulties that arise at a time like this is the looseness that has obtained in the making of many contracts, whereby some buyers long ago placed contracts for larger quantities of steel than they could possibly consume, or even accept delivery upon, within the contract period. As the mill fell behind in deliveries it could not effect the usual cancellation of unspecified tonnages because the buyer was secure in furnishing the specifications, knowing that the delivery would be delayed. It is a delicate matter for the mill to determine the precise rights of such a buyer, for the essence of the contract was protection to the buyer for a specified period, to permit him to conduct his business during the period with an adequate supply of material, while the letter of the contract is that a much larger tonnage is to be furnished. The buyer naturally contends that the question of his ability to accept the material does not arise, because the mill did not test his ability by offering him delivery of the additional material.

A question of an entirely different nature, but also one of the moral obligation of the seller, is arising in the pig-iron trade. The typical blast furnaceman has his current output sold at practically uniform prices, for until the recent advance the pig-iron market stood at a practically unchanged level for months. The furnaceman has sold his pig iron on contract, while he has contracted for a supply of coke. Now, in many instances the supply of coke is insufficient for the full operation of the furnace. A conventional case may be stated, probably typical of many actual cases. The pig iron has been sold at $18 and coke has been contracted for at $2.50 at Connellsville ovens. The profit in the pig iron at these prices is $2.50 per ton. The furnace receives an insufficient supply of coke, and with it must slow down operations by, let us say, 15 per cent. Shipments of pig iron are reduced and the consumer is inconvenienced. The furnaceman, perhaps, could buy coke in the open market at $7.50 and thereby operate at capacity. Not to make the calculation too fine, there would be 85 tons of coke at $2.50 and 15 tons at $7.50, to produce 100 tons of pig iron. The extra cost of coke on the 100 tons would be $75, whereby the furnaceman's average profit would be reduced from $2.50 to $1.75 per ton. The buyer might assert that the furnaceman should be quite ready to stand this slight reduction in his profits. The furnaceman might rejoin, however, that the extra 15 tons of pig iron was made at a loss of $5 a ton, and he did not care to incur that loss. He would make the 85 tons at the expected profit and the failure to make the other 15 tons was due to "causes beyond his control." He had made a contract to deliver pig iron and he had made a contract whereby he was to receive coke, and he would stand on the basis that those two contracts were of equally binding force.

The case may be simply one of right and wrong when it is between one furnace and one consumer, but if there were many such cases the question of right or wrong would quickly be dispelled by physical conditions. When spot coke advances to $7.50 many furnaces cannot buy at that price. The payment of the price does not increase the production of coke, and the higher the price bid the more temptation there is for the coke producer to "fall down" on his contract and sell spot coke. The attempt of many furnaces to augment their supplies by open market purchases would tend to undermine the morals of the coke producer instead of causing more coke to be made. If on the other hand many furnaces curtailed their production of pig iron, the consumers might be forced into the spot market for pig iron, causing fancy premiums to obtain on spot iron, thus tending to undermine the morals of the furnacemen. Once the suspicion arises in the mind of a producer, whether of coke, of pig iron or what not, that his competitors are profiting by a high spot market at the expense of contract obligations, he is tempted to do likewise, and eventually many may be doing so, each blaming the condition upon whomever it was that started it. Each consumer, then, is to a large extent buying his own material at an advanced price. It would be well for every buyer and seller to consider seriously these possibilities, for the trade stands in danger of unpleasant developments.

Charles M. Schwab on the Situation

On Thursday of last week, while in St. Louis to attend the meeting of the American Iron and Steel Institute, Charles M. Schwab spoke at a luncheon given him by the Members' Conference of the Business Men's League. He said that the Bethlehem Steel Company has sold all its product for 1916 and that practically all the steel it could make in 1917 was under contract. Referring to the new construction of his company he said: "In the face of a certain amount of opposition on the part of the directors of the corporation with which I am affiliated, I have insisted upon spending $90,000,000 within the next two years for improvements, beginning immediately." Mr. Schwab predicted that following the present unprecedented prosperity a period of financial depression would come upon the United States in the next five or ten years, and that this would bring an entire commercial and financial readjustment which would serve to teach the people of this country economy.

One View of the Pace in Pig Iron

In the pig iron market report from their Cincinnati office, under date of Oct. 28, Rogers, Brown & Co. say: "The pig-iron market is so active that it is difficult to keep up with the procession. All quotations are being made subject to confirmation and by the time the buyer receives a price and hurries in his order he finds that he is behind so far that he can't even hear the band, and negotiations have to be again opened."

Installations of Heroult Electric Furnaces

The Halcomb Steel Company, Syracuse, N. Y., has contracted with the United States Steel Corporation for two more 6-ton Heroult electric furnaces. These are in addition to the two Heroult furnaces and the one Snyder furnace now operating. The number of Heroult furnaces operating or contracted for in the United States and Canada is now 80, while on Jan. 1, 1916, it was 43.

STEEL CORPORATION EARNINGS

Net Earnings for the September Quarter $85,817,067, Making a New High Record

The United States Steel Corporation has issued its statement of earnings, covering its subsidiary companies, for the quarter ended Sept. 30, 1916. The amount of the earnings is $4,691,019 in excess of the brilliant showing for the second quarter. It compares as follows with the corresponding quarter of 1915:

	1916	1915
July earnings	$25,650,006	$12,048,218
August earnings	29,746,903	12,869,099
September earnings	30,420,158	13,793,327
Total earnings after deducting all expenses incident to operations including those for ordinary repairs and maintenance of plants and interest on bonds of subsidiary companies	85,817,067	38,710,644
Less charges and allowances for depreciation, viz.:		
Sinking funds on bonds of subsidiary companies and depreciation and extraordinary replacement funds	8,867,392	7,028,034
Sinking funds on U. S. Steel Corporation bonds	1,747,267	1,636,819
Net income	75,202,408	30,045,791
Deduct interest for the quarter on U. S. Steel Corporation bonds outstanding and premium payable on bonds redeemable under sinking funds	5,601,233	5,703,631
Balance	69,601,175	24,342,160
Dividends for the quarter on stocks of the U. S. Steel Corporation, viz.:		
Preferred, regular, 1¾ per cent	6,304,919	6,304,919
Common, regular, 1¼ per cent	6,353,781	.....
Common, extra, 1 per cent	5,083,025	.....
Surplus for the quarter	$51,859,450	$18,037,241

The directors have again favored the common stockholders with an extra dividend, making a total return of 7 per cent this year on the common stock. A year ago the dividend on the common stock was passed.

Total net earnings for the first nine months of this year were $227,656,739, against $79,118,508 in the corresponding period of 1915. The total surplus for the nine months, after dividends, was $132,678,157, against $20,915,025 in the same months of 1915.

Bids for Navy Shells

Bids opened Oct. 25, at the Frankford Arsenal, Philadelphia, for furnishing the navy with 93,333 4.7-in. shells, were as follows:

American-British Mfg. Company, entire quantity at $10.20; final delivery July 31, 1917.

Harrisburg Pipe & Pipe Bending Company, entire quantity, $11.34; final delivery July 31, 1917.

E. W. Bliss Company, entire quantity at $12.97; final delivery July 31, 1917.

Edwards Valve & Mfg. Company, to commence in 130 days, delivery 500 per day until completed, $15, entire quantity.

Bridgeport Projectile Company, entire quantity, $11.30; commence in 120 days, complete delivery July 31, 1917.

Ingersoll-Rand Company, entire quantity, at $14.50, complete delivery Sept. 30 next; $15.50, complete delivery Aug. 31 next; $16, complete delivery July 31 next.

Union Switch & Signal Company, entire quantity at $11.95; final delivery July 31 next.

Crucible Steel Company of America, 30,000 shells at $20.54; deliver 1000 in eight months and afterward 4000 per month.

Bethlehem Steel Company, entire quantity at $12.75; commence in six months and deliver at rate of 10,000 per month.

At a meeting of directors of the Brier Hill Steel Company, Youngstown, held last week, it was decided to retire all outstanding bonds at the next interest period, which comes on Feb. 1, 1917, and thus clear all obligations of this kind against the company. The bonds were issued to liquidate floating debt and for other corporate purposes, and were sold at the close of 1914, when trade conditions were extremely depressed. An issue of $3,000,000 had been authorized, but only $2,051,000 were sold.

Wharton Steel Company Acquired by Replogle Interests

Ernest Hillman, of J. H. Hillman & Sons Company, Pittsburgh, is understood to have concluded negotiations in the past week by which the Wharton Steel Company and its properties passed to J. Leonard Replogle, vice-president of the American Vanadium Company. Mr. Replogle has associates in the undertaking but details on this point have not been given out. One report has pointed to a connection of the Crucible Steel Company of America with the project. It is understood that coke ovens will be built and other considerable improvements made. The new owners of the property made an inspection of the blast furnaces and the Wharton iron mines this week.

It will be recalled that N. L. C. Kachelmacher and others took an option in the latter part of 1915 on the Wharton Steel Company properties at $1,500,000. These promoters exercised their option in January, 1916, but owing to complications no actual transfer of the property ensued. Before the last deal was put through it is understood that a trust company secured a release of any claim that Kachelmacher and his associates had by virtue of their option. The negotiations were then directly between the Wharton executors and the new owners. The properties include two large blast furnaces and a smaller one, also the Hibernia mine near Wharton, N. J., and smaller mines in the same group, including the Allen-Teabo, Orchard, Scrub Oaks and Mount Pleasant—in all about 5000 acres of iron ore lands. The Hibernia, which is the largest mine, has reserves estimated at 4,000,000 to 5,000,000 tons of ore. The Kachelmacher syndicate at one time had plans for by-product ovens and an open-hearth steel plant.

Large Argentina Pipe Contract

The manufacturing interests of this country should feel much gratification at the success of a cast-iron pipe company in securing a large foreign contract. At various times strong but generally unsuccessful efforts have been made by our pipe manufacturers to secure some of the important orders which are being placed by users in foreign countries. South America has long been a section in which European pipe manufacturers have ruled supreme. They have hitherto been able to control the South American pipe trade partly by making more attractive prices and partly by reason of the better shipping facilities from European to South American ports than from ports in the United States.

It is therefore a matter of no little exultation to record the booking by the United States Cast Iron Pipe & Foundry Company of a contract with a department of the government of Argentina for 60,000 metric tons, or about 66,000 net tons, of cast-iron pipe. This tonnage would be of major importance even for steel rails or other steel products frequently contracted for in large quantities, but it is exceptionally large for such a product as cast-iron pipe. The sizes run up to 44 in. in diameter and will all be based on the metric system, the sizes from 12 in. up being 4 metres long, while the smaller sizes will be of the standard length used in this country. The price realized in this transaction is a shade under $60 per metric ton. The pipe will be produced subject to the inspection of engineers designated by the purchaser, and shipments to Buenos Aires will begin early in the coming year. The pipe purchased is not for use in only one municipality, but will be distributed by the government to various localities in Argentina.

It is interesting to note that the contract came to the United States as the result of sharp competition with foreign manufacturers and not because the pipe makers of other countries were not in position to take the business. It is more than twice as large as the Argentina pipe contract placed with a British company a few months ago, but which would have been taken by the United States Company if it had been able to meet the delivery requirements then insisted upon.

September's Phenomenal Export Record

Tonnage Exports of Iron and Steel Make New High Record, Exceeding August Figures by Over 45,000 Gross Tons

WASHINGTON, D. C., Oct. 31, 1916.—The great record of exports of iron and steel made in August was surpassed by a substantial margin in September, according to the official figures compiled by the Bureau of Foreign and Domestic Commerce. In both total values for the entire group and aggregate of tonnage commodities gains were made, but shipments of machinery showed a decline, which is attributed in part to the fact that the fitting up of new munitions plants in the belligerent countries has been nearly completed, current orders being chiefly for replacements and extensions. But for embargoes, a car shortage that is being acutely felt in the iron and steel trade, and the fact that September embraced but 25 official working days, the gain in total exports over August would have been much greater.

Exports of Iron and Steel

	September		Nine Months	
	1915 Gross Tons	1916 Gross Tons	1915 Gross Tons	1916 Gross Tons
Pig iron	29,222	64,122	156,929	302,504
Scrap	10,290	36,519	40,383	158,352
Bar iron	6,560	6,948	26,603	59,193
Wire rods	17,909	10,793	121,981	118,377
Steel bars	37,637	64,169	298,335	588,753
Billets, ingots and blooms, n.e.s.	54,782	163,104	407,901	1,051,669
Bolts and nuts	2,514	2,565	15,401	21,916
Hoops and bands	3,145	4,556	19,033	34,146
Horseshoes	671	837	13,973	7,043
Cut nails	649	877	3,134	3,672
Railroad spikes	600	1,579	4,838	20,140
Wire nails	9,558	15,369	66,434	114,710
All other nails, including tacks	938	1,686	6,134	7,764
Cast-iron pipes and fittings	6,319	7,558	36,769	49,931
Wrought pipes and fittings	8,615	17,724	92,230	111,238
Radiators and cast-iron house heating boilers	327	226	1,650	1,858
Steel rails	41,060	86,676	219,494	391,449
Galvanized iron sheets and plates	6,222	7,652	64,018	62,775
All other iron sheets and plates	4,524	2,869	16,101	34,305
Steel plates	26,235	24,385	164,995	196,494
Steel sheets	10,069	9,677	72,857	77,787
Structural iron and steel	26,714	29,336	165,905	211,869
Tin and terne plates	22,271	18,769	105,065	179,126
Barb wire	32,827	42,404	172,974	341,919
All other wire	21,659	23,363	168,061	211,566
Total	381,317	643,763	2,461,198	4,358,189

The total shipments of iron and steel products in September on a basis of values rose 138 per cent as compared with the same month of 1915 and gained 5.3 per cent over the record figures of August of this year. Tonnage commodities gained 70 per cent over September, 1915, and rose 7.5 per cent above the high-water mark of August. Shipments of machinery in September scored a gain of 68 per cent over the same month of 1915 but declined 17 per cent as compared with August of this year. Shipments of machine tools exceeded those of September, 1915, by 141 per cent but decreased 20 per cent as compared with the record, which was made in May of this year.

For the nine months ended September the total exports of iron and steel surpassed the high record of 1915 by no less than 147 per cent. Tonnage commodities gained 76 per cent over the corresponding months of 1915, while exports of machinery rose 83 per cent over 1915 and 74 per cent over the record total of the same period in 1913.

The value of all shipments of iron and steel products in September, 1916, was $90,895,592 as compared with $38,415,180 for the same month of 1915 and $12,531,102 for September, 1914. The previous high record for exports of iron and steel was made in August of this year, when the total was $86,297,703. For the nine months of 1916 the total was $619,853,667 as compared with $251,112,482 for the same period of 1915, which, in turn, exceeded any previous nine months' figures by $25,000,000.

EXPORTS OF TONNAGE IRON AND STEEL

The exports of iron and steel for which quantities are given aggregated 643,763 gross tons in September, 1916, as compared with 381,317 tons in the same month of 1915. The record for these exports was made in August of this year, when the total was 598,192 tons. The total for the nine months of 1916 was 4,358,189 gross tons, as against 2,461,198 tons for the same period of 1915.

An accompanying table shows the exports of tonnage iron and steel for September and for the nine months ended September, 1916, as compared with 1915.

Exports of Machinery

	September		Nine Months	
	1915	1916	1915	1916
Adding machines	$107,038	$83,617	$420,758	$1,040,486
Air-compressing machinery	66,186	119,178	351,075	632,733
Brewers' machinery	1,468	404	55,408	11,729
Cash registers	111,379	83,154	976,263	1,254,263
Parts of	4,908	5,176	75,643	108,886
Cotton gins	8,444	12,438	48,526	73,704
Cream separators	26,341	24,087	219,290	307,449
Elevators and elevator machinery	84,839	245,650	638,350	1,374,419
Electric locomotives	3,293	18,831	199,270	395,873
Gas engines, stationary	22,054	25,765	357,536	274,494
Gasoline engines	586,948	909,458	4,106,252	12,165,657
Steam engines	1,551,669	759,379	4,054,341	8,278,243
All other engines	54,746	471,654	767,418	3,926,284
Parts of	437,939	1,548,693	3,233,649	7,859,717
Laundry machinery, power	29,706	29,118	245,651	241,523
All other	27,375	51,998	186,884	198,459
Lawn mowers	8,520	11,463	255,274	182,182
Metal-working machinery (including metal-working tools)	3,256,973	7,901,328	30,844,199	63,218,202
Meters, gas and water	7,153	18,786	187,168	289,839
Milling machinery (flour and grist)	335,493	109,434	1,826,660	1,807,979
Mining machinery, oil well	70,694	102,700	1,004,264	1,542,320
All other	550,137	680,240	3,975,812	4,949,977
Paper-mill machinery	92,271	81,028	676,467	607,013
Printing presses	90,138	170,002	1,065,529	1,430,045
Pumps and pumping machinery	392,138	549,121	2,298,447	4,072,779
Refrigerating machinery (including ice-making machinery)	25,302	60,676	630,904	544,615
Sewing machines	393,635	465,424	4,469,366	4,209,705
Shoe machinery	139,693	119,721	1,142,801	786,171
Sugar-mill machinery	606,008	1,173,993	2,379,134	4,202,165
Textile machinery	183,120	220,618	1,386,619	2,609,985
Typesetting machines	44,313	85,630	338,558	878,181
Typewriting machines	505,180	905,932	5,121,475	8,243,380
Windmills	90,514	46,779	654,525	808,577
Woodworking machinery, saw-mill	20,579	30,637	265,841	321,352
All other	146,579	68,450	690,953	677,183
All other machinery and parts of	2,194,616	3,317,911	16,523,967	28,981,718
Total	$12,277,389	$20,508,455	$91,674,277	$168,570,287

EXPORTS OF MACHINERY

Exports of machinery in September, 1916, were valued at $20,508,555 as compared with $12,277,389 for the same month of 1915. August, 1916, still holds the record with a total of $24,657,597. Shipments of metal-working machinery aggregated $7,901,328 in September compared with $3,256,973 for the same month a year ago and $9,935,806, the high record of May of the present year. Exports of machinery of all kinds for the nine months ended September, 1916, were valued at $168,570,287 as compared with $91,674,277 in 1915 and $97,222,090 for the same period in 1913.

Details of the exports of machinery for September, 1915 and 1916, and for the two nine months' periods are given in an accompanying table.

IMPORTS OF IRON AND STEEL

Imports of tonnage iron and steel in September amounted to 28,557 gross tons as compared with 31,814 tons for the same month of 1915. The imports for the nine months of 1916 were 203,025 tons as against 392,518 tons in 1914.

The following table shows the imports of tonnage commodities for September, 1916, and for the nine months ended September as compared with 1915:

Imports of Iron and Steel

	September		Nine Months	
	1915 Gross Tons	1916 Gross Tons	1915 Gross Tons	1916 Gross Tons
Ferromanganese	....	9,787	....	58,474
Ferrosilicon	9,395	550	220,848	5,071
All other pig iron	5,273	5,394	57,117	34,251
Scrap	9,229	6,340	29,918	47,772
Bar iron	813	953	6,595	6,745
Structural iron and steel	49	13	1,202	1,081
Steel billets without alloys	2	163	1,118	8,298
All other steel billets	769	4,055	8,061	11,474
Steel rails	6,273	862	60,646	24,438
Sheets and plates	66	94	923	1,311
Tin and terne plates	31	51	2,220	826
Wire rods	614	295	3,870	3,284
Total	31,814	28,557	392,518	203,025

The failure of iron and steel imports to share in the upward movement that has marked the imports of many important classes of merchandise has been a notable feature of these statistics throughout the current calendar year to date, but merely reflects the enormous demand in the belligerent countries for these commodities for the manufacture of war material. W. L. C.

At a meeting of the New York Section of the American Chemical Society, which will be held Nov. 10 at the Chemists' Club, 50 East Forty-first Street, New York, the papers to be presented will bring out very forcibly the relation of the chemist to our public welfare. They are "The General Problem of Public Service Training," by Prof. Charles A. Beard, of Columbia University and of the Training School for Public Service; "The Status and Compensation of the Chemist in Public Service," by Prof. Frederick E. Breithut, of the College of the City of New York; "The Chemist in Public Service," by Dr. Harvey W. Wiley, formerly chief chemist, Bureau of Chemistry, United States Department of Agriculture; "The Chemist in the Service of New York City," by Dr. Otto H. Klein, director of the Central Testing Laboratory. The public is invited.

The Nagle Steel Company, Pottstown, Pa., has acquired the plant of the New Jersey Steel Company, Rahway, N. J., which has for some time been idle and in the hands of a receiver. The plant is equipped for the manufacture of steel castings and has a 25-ton open-hearth furnace and three Tropenas converters—two 2-ton and one 4-ton. The purchaser will probably operate the plant in the production of steel ingots and will ship them to Pottstown to be finished into plates.

The Stamford Rolling Mills Company, whose sales office is at 25 Broad Street, New York, is having additions built to its plants in Springdale and Stamford, Conn. These additions include an office building, another casting shop, storehouse extension and several small buildings to house the recovery plant and other departments.

CONTENTS

A Successful Shop Suggestion System 983
New Thrust Bearing of the Ball Type 985
An Internal Cylinder Grinding Machine 985
Structure and Properties of Steel Ingots 986
Hollow Set Screw Threading Machine 989
Large Foreign Demand for Ferrovanadium 989
Bids for New Warships 990
Press for Stamping Washers from Sheets 991
Roughing Machine for Bevel Pinions 992
New 30-In. Heavy-Duty Engine Lathe 992
Iron and Steel Institute Honors Judge Gary 993
Duplex Process of Lackawanna Steel Company 999
The Fuel Famine 1002
Machine Tools and the Future 1002
Need of Fatigue Studies 1003
Contracts and Deliveries 1003
Charles M. Schwab on the Situation 1004
One View of the Pace in Pig Iron 1004
Installations of Heroult Electric Furnaces 1004
Steel Corporation Earnings 1005
Bids for Navy Shells 1005
Wharton Steel Company Acquired by Replogle Interests 1005
United States Gets Large Argentina Pipe Contract 1005
September's Phenomenal Export Record 1006
Transue & Williams to Be Expanded 1007
The French Steel Industry in War Time 1008
Iron and Steel Markets 1010
Iron and Industrial Stocks 1021
Finished Iron and Steel Prices, Pittsburgh 1022
Metal Markets 1023
Bethlehem Enlargements at Sparrows Point 1023
Obituary 1024
Merrimac Foundry & Machine Auction Sale 1024
Personal 1025
United Alloy Steel Corporation's Officers 1025
United States Ordnance Bids 1025
Pittsburgh and Nearby Districts 1026
Large Orders for Locomotives 1026
Site Secured for Worth Steel Plant 1026
Machinery Markets and News of the Works 1027
New Trade Publications 1034
Pulverized Coal as Fuel for Open-Hearth Furnaces 1037
Iron Ores of the Adirondack Region 1039
Annual Meeting of Machine-Tool Builders 1043
Obstacles to Metric System 1045
American Shipbuilding Company's Report 1046
Steel Conductors for Electric Transmission Lines 1046
Zinc Dust by a New Process 1047
British Iron and Steel Research 1047
Judicial Decisions 1048
Customs Decisions 1048

Transue & Williams to Be Expanded

The Transue & Williams Steel Forging Corporation has been formed, with an issued capitalization of 100,000 shares, to take over the business of the Transue & Williams Company, Alliance, Ohio, which was established in 1898, and has a capacity of 40,000 tons of drop forgings and 4000 tons of stampings per annum. A syndicate, composed of Hornblower & Weeks, Dominick & Dominick, and Kissel, Kinnicutt & Company, is taking subscriptions privately for 70,000 shares which are being offered at $45.50.

The net earnings for the first seven months of 1916 are said to have been $648,026, or at the rate of $12 per share per annum. Net earnings in 1915 were $671,251. Current net earnings are running at better than $100,000 a month. Unfilled orders on hand total over $3,600,000, which will keep the plants of the company in operation to capacity well into 1917. With the additional funds made available by the new financing the facilities of the company will be doubled. The management of the new company will be substantially the same as that of the old company.

The French Steel Industry in War Time

Report of Joseph G. Butler, Jr., as a Member of the American Commission Indicates a Doubling of the 1915 Output

Joseph G. Butler, Jr., Youngstown, Ohio, who represented the steel trade of the country on the American Industrial Commission to France, arrived at New York on the return journey of the commission on Oct. 29. While the general report of the commission, which went out under the auspices of the American Manufacturers' Export Association, will not be published until late in the year, THE IRON AGE is able to give to its readers below Mr. Butler's report of his investigations into the war status of the iron and steel industry of France:

W. W. NICHOLS,
Chairman American Industrial Commission to France.

My dear Sir: In accordance with your request, I beg to submit the following report, which is the result of observations and information obtained, regarding the particular industry represented by me.

Quite unfortunately, there were only a few visits to steel plants of any importance and the information gained is rather superficial. I noticed a dearth of labor-saving devices, and quite prominently the absence of safety appliances. I also observed that notices to the employees calling attention to probable dangers were not as plentiful as in any model plant in the United States. It is quite probable that there are many plants in France that are more up-to-date than those we visited.

I have information in regard to the condition of the iron and steel business in France at the outbreak of the war, but we are only concerned with its present condition and its probable condition when the war is ended.

The acquisition by Germany at the close of the so-called Franco-Prussian war resulted, as is well known, in Germany taking over the tremendous fields of iron ore and coal located in Alsace-Lorraine. It is my belief that this absorption is largely responsible for the prosperous condition of the iron and steel business in Germany and its being in second place in the world's production. I am assured by men prominent in the iron and steel trade in France, and by others connected with the government, that the war will not end until these valuable mineral deposits have been restored to France. It is remarkable that with this serious handicap, France has been able to accomplish so much in the way of steel supplies for its munition plants and other plants making war material accessories.

From my observations, nearly all the iron and steel now produced in France is being turned into war material and materials required for other purposes have been furnished in a minimum and scanty way. In other words, the whole of the iron and steel interests in France have been mobilized by the French Government.

PRODUCTION IN FREE TERRITORY DOUBLED

The last report I have seen on steel and iron production in France is dated May, 1915, but I am told on good authority that since that date the production has been doubled.

With the reacquisition of the Alsace-Lorraine iron and coal deposits and possibly the acquirement of other fields which our French friends seem to have in mind there will still be a shortage of coal. However, it is expected that after the war closes, France will necessarily be obliged to export a good portion of its production of iron and steel, by reason of the increased productive capacity of its iron and steel plants.

Incidentally I might mention that, when we were in Marseilles my attention was called by the Chamber of Commerce to the fact that France would be in a condition to export large quantities of iron ore from Algeria to the United States, and if this project could be worked out and return cargoes of American coal brought to France it would be very desirable, meeting the shortage of coal, which is inevitable. The analysis of this Algerian ore shows the quality to be such as would produce high-grade steel materials. A detailed analysis will be furnished to any one who may be interested.

It is interesting to note that in the departments of Calvados, Manche and Orne, there are rich deposits of iron ore yielding in some cases 45 to 50 per cent metallic iron. These deposits before the war were leased by the Thyssen group of German steel manufacturers, but are now in the hands of the French sequestrators. I understand that quantities of this ore also were in great demand, and frequently shipped to the iron works of South Wales.

I examined the steel plant making steel by the electrical process, but the examination was very brief. I have assurance, however, that the manufacture of steel by electricity in France has been very successful not only mechanically but financially and is sure to grow. There seems to be a large area in the eastern part of France, where water-power is available, and I think that many new plants, and much activity will prevail in this particular region, when affairs again become settled. The use of water-power will overcome to a large extent the shortage of coal.

LITTLE STEEL FROM THE UNITED STATES AFTER THE WAR

I think that when the war ends, the imports to France from the United States of iron and steel will be confined to special forms and that France will be able to compete not only with the United States, but also with other countries in the matter of exports of general iron and steel products.

With the port improvements contemplated at Bordeaux and Marseilles, world-wide markets will be opened for France. The contemplated improvements at both these places will, no doubt, be fully cared for in other special reports, or perhaps in the general body of the report which the commission may issue. The canal at Marseilles should receive special mention in the general report.

The tariff question in France is in about the same condition as in the United States, with the exception that in France customs duties are handled quickly and settled expeditiously by the government. Duties may be raised or lowered over night to meet contingencies.

WOMEN WORKERS

The labor in French iron and steel plants is paid very much less than in the United States; in many instances one-half and even less. There are very few disturbances, and dictatorial labor unions such as we have in the United States are unknown in France.

A large number of women are employed in France doing men's work, which keeps wages at a lower level than would otherwise be possible. All the members of the commission have seen in their travels women doing men's work, and performing manual labor which in our country would not be thought of for a moment. Em-

ployment of women in steel and munition plants has, of course, increased the number of women workers since the war commenced. This, I think, is largely brought about by the patriotic feeling which prevails all over France. "Working for France" is a slogan rooted and imbedded in the minds of the people, whether they are soldiers, or engaged in any other occupation which may tend to end the war and save France.

CO-OPERATION AMONG MANUFACTURERS

Co-operation in France among all manufacturers of iron and steel and in fact all other industrial works is marvelous, and could well be imitated in our own country. The various special branches of metal trades have both local and national syndicate organizations for the discussion of their trade problems, and means of voicing the particular needs of their trade, on which a majority sentiment has been expressed. These chamber syndicates are in turn combined into a National Union. These national unions are members of the Comite des Forges de France, which is the cap stone of the trade organizations of the steel and iron industries. The most striking fact to an American regarding the personnel of the governing board and general committee of the Comite des Forges de France is that a considerable number of its members are in one or the other of the legislative bodies, and practically hold positions at the head of the Government Committees, organized to look after the very business in which they are engaged.

In spite of the fact that at the beginning of trench warfare, France had lost behind the German line 80 per cent of her normal pig-iron production, and 70 per cent of her steel production, it has been possible by the utilization of lower grade ore in other districts of France, and which were not exploited to any extent previously, to increase the steel production of the country 100 per cent over that of last year. The interesting fact regarding this is that of the production which has been cut off the larger part in pig iron is of so-called Thomas iron (non-Bessemer), and in the case of steel, mostly "Martin" or acid open hearth. Neither of these products enters to any considerable extent into the manufacture of projectiles. The plants in the center and southern part of France were already producing the special qualities of steel required for artillery use, hence the amount of special quality steel brought in from foreign countries, in both the raw and semi-manufactured state, was an immediate necessity for the country at the outbreak of hostilities. It is also noticeable, and based on information obtained from leading steel manufacturers, that many idle and in some cases abandoned plants have been rehabilitated and utilized as far as possible. As a matter of fact, I am told that there is not a single idle plant of any kind formerly engaged in the manufacture of fabrication of steel that is not now in full operation, either in its original form or by being transformed into a munitions plant.

COMMERCIAL CO-OPERATION WITH GREAT BRITAIN

It is only too evident that the present pre-occupation of steel manufacturers is to bend every effort to assist in the final military victory of the Allies. However, I met steel manufacturers, conversing with them freely, and their mental attitude is that when the military victory has been achieved and France has again entered into possession of her own, they are determined to succeed in producing a close union with the British producers and thus prevent a rapid return of German industrial prosperity. With this fact in mind, it seems clear to me that the United States will have to make up its mind in which field it will choose to work. It certainly will be impossible to continue to hold a position of theoretical neutrality.

Welfare work in Le Creusot is in a high state of efficiency. Comfortable modern dwellings are furnished the employees at low rental. Hospital facilities are of the best and everything is done to bring the workman in close and harmonious relations with his employer.

It has been suggested that I embody in this report something with reference to the mines in France, but as the data concerning them have been printed in public documents of the French Minister of Mines, I will omit this detail with the single word that these reports include minerals of all kinds.

I am indebted to John Weare, representative of the United States Steel Products Company in France, for valuable information in the preparation of this brief report.

JOSEPH G. BUTLER, JR.

REPORT OF CHAIRMAN OF COMMISSION

The preliminary report of the commissioner general of the American Industrial Commission to France, W. W. Nichols, assistant to chairman of the Allis-Chalmers Mfg. Company, Inc., and first vice-president of the American Manufacturers' Export Association, was made at the afternoon session of the annual meeting of the association at the Hotel Biltmore, New York, Oct. 31. It was in part as follows:

"France is ready, indeed eager, for a commercial reciprocity with the United States. We encouraged a belief that the United States could not have the remotest intention to exploit industrial France for the sole benefit of industrial United States; that to establish a permanent prosperity in its relations with France it must consult France's every need in order to cater to them.

"The Commission discovered a strong disposition on the part of industrial France to acquire the best in our American practice which with high efficiency has developed labor-saving devices for the very lines of endeavor to which the needs of France are now addressing themselves. This was found not only in the factories requiring machine and other tools, but in agricultural districts, ship and railroad terminals, etc. While France is in a receptive mood and prepared to weigh the merits of anything that will compensate for the losses sustained in the manual labor that has been in the past her mainstay it behooves us to consider well her invitation. The report which the Commission is preparing will be full of suggestion in a technical treatment under twenty-four heads which will be printed for distribution as soon as possible.

"The tour in France of about 3000 miles occupied about 45 days; half the distance was made in automobiles. Important enterprises were examined in the best manner in the limited time; discussions were held with chambers of commerce and other economical associations; government and statistical authorities were consulted in an earnest endeavor and by constant application to learn all that could be learned by aid of unusual facilities freely offered."

At the banquet held Tuesday evening Dr. E. E. Pratt, chief of the Bureau of Foreign and Domestic Commerce, made an address on "Where Do We Stand," which was much in line with his recent utterances on the subject before various trade bodies. He does not hold that the United States will be flooded by low-priced European products after the war.

Edward N. Hurley, chairman Federal Trade Commission, in talking of "The Exporter and the Nation," closely followed a prepared address in which he expressed the hope that the restraint which manufacturers had met in their efforts to build up the necessary organization for export trade would be removed by the passage of the Webb bill, with some essential amendments, at the coming session of Congress.

Mark Sullivan, editor-in-chief of *Collier's Weekly*, said that this country has suffered greatly from the cutting off of 1,000,000 immigrants a year. His guess was that it would be long before the old basis was restored. Exporting goods means making them cheaply, and this requires ample labor. He said it would not be surprising to see a labor famine in the United States in the next few months, and that the question of admitting Japanese and Hindoos would be raised.

Iron and Steel Markets

PIG IRON FOLLOWS STEEL

Prices Advance in an Unprecedented Way

Export Inquiry for Steel Nearly Half of Production—Pipe Prices Up

The pig-iron market of the past two weeks is practically without a parallel in the experience of present-day producers. Following advances of $1 to $2 a ton recorded a week ago, prices in all Northern selling centers have gone up $2 to $3 more, with every indication that higher levels will be reached.

The advances are unprecedented in being due, not to a clamorous demand for iron for quick shipment, as in all previous excited markets, but to a simultaneous effort of buyers to cover far forward requirements—in many cases through the second half of 1917.

The situation is, in a word, that the pig-iron market, after months of lagging, has cut loose and is now for the first time showing likeness to the war market for steel.

Merchant furnaces in all sections made heavy sales last week and many have now only a fraction of their 1917 output to offer. The movement was sudden. Less than two weeks ago foundries refused to consider iron for the second half of next year. A few days later they found the output for that period being rapidly taken up. At Buffalo the announcement that the Lackawanna Steel Company had contracted for the output of two Susquehanna furnaces for the second half of next year tightened that market appreciably.

In Southern iron excitement was caused by the report, now known to be incorrect, that in addition to the 200,000 tons recently bought from two companies for shipment to Great Britain and its Allies, a new order had been received for an equal amount. From $16 last week Alabama No. 2 iron has advanced to $17, and sales have been made in the past few days at this figure, for both first and last half of next year.

No. 2 Northern foundry iron has advanced to $23 at Ohio and western Pennsylvania furnace, to $24 at Chicago furnace and to $25 at Buffalo. A good many furnaces are now refusing to quote, expecting to get more money for the small part of their 1917 output that is unsold.

Steel-making irons have advanced $2 a ton, Bessemer now selling at $26 at Valley furnace and basic at $22, these prices being established by a 10,000-ton sale in each case. A 50,000-ton transaction in basic, shipments through all of 1917, involves monthly settlements at market prices. The great demand for Bessemer iron from abroad is felt as a factor in the Lake Superior ore situation, Bessemer ores being rapidly taken up for next year. Even more than $1 a ton advance for such ores is now talked of.

Lake ore reservations of a leading Eastern steel company are now fully 1,000,000 tons.

Export business declined by domestic steel manufacturers continues to mount up. For a time such offerings have been at the rate of nearly half our total steel output. While war steel contracts for the second half of 1917 have not been signed, the amount figured on is very large and 4c. to 4½c. will be paid on much of it, though a leading seller is asking less.

An interesting inquiry just received is for 27,000 tons of 6-in., 7-in. and 8-in. beams and 17,000 tons of ¾-in. to 2-in. angles for France.

Advances announced by the Carnegie Steel Company and Illinois Steel Company put plates for delivery at the convenience of the mill at 3.25c., Pittsburgh, shapes at 2.80c. and bars at 2.70c., Pittsburgh.

Effective Nov. 1 new discounts on lap weld iron and steel pipe, including line pipe, represent an advance of $2 a ton for black and galvanized. Iron and steel boiler tubes were advanced $4 a ton.

In woven wire fencing a shortened discount became effective this week—58 per cent as against 59 per cent previously.

October outputs have been the largest the industry has known. But car shortages are now a serious menace. Fuel and other costs are running up and delivery troubles promise to be worse as winter comes on. Spot coke prices have relaxed a trifle. Thus far $3.75 has been the basis of contract blast-furnace coke for the first half.

Estimates of the Steel Corporation's loss in ingot production in July, August and September due to hot weather and workmen under par run from 550,000 to 650,000 tons.

Pittsburgh

PITTSBURGH, PA., Oct. 31, 1916.

The past week has been an eventful one. Prices on Bessemer, basic and foundry pig iron have advanced fully $2 per ton, with indications that a much higher level will be reached. In semi-finished steel in the forms of billets and sheet bars prices are anything the mills care to quote if they will agree to furnish the steel. There probably would not be any trouble in getting $55 a ton at mill for soft Bessemer or open-hearth billets or sheet bars, while for export $60 would likely be paid and on high carbon billets for forging purposes practically $90 a ton at mill has been done. It is a runaway market in pig iron, semi-finished steel and on most lines of finished material. All in the trade admit that prices are dangerous and that a violent reaction is bound to come, but when this will happen is a question. Should peace negotiations suddenly start, the effect would probably be a quick and sharp decline. The export demand for pig iron and steel is so heavy that it is more than sufficient to take up any surplus producers can offer, and at better prices than they get from the domestic trade. The serious trouble now in the steel trade is the shortage in cars and labor, and this is holding back shipments and restricting output. No relief can be expected, but the situation is liable to get worse before it gets better. Some of the railroads are refusing to allow their cars to be loaded when they are routed to pass over other lines, claiming that these lines hold up their cars longer than

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month, and one year previous

For Early Delivery

Pig Iron, Per Gross Ton:	Nov. 1, 1916.	Oct. 25, 1916.	Oct. 4, 1916.	Nov. 3, 1915.
No. 2 X, Philadelphia...	**$22.50**	$21.00	$19.75	$16.75
No. 2, Valley furnace...	**23.00**	21.00	19.00	15.00
No. 2 Southern, Cin'ti...	**19.90**	18.90	17.40	15.90
No. 2, Birmingham, Ala.	**17.00**	16.00	14.50	13.00
No. 2, furnace, Chicago*	**24.00**	22.00	18.50	16.50
Basic, del'd, eastern Pa.	21.50	21.50	20.00	17.00
Basic, Valley furnace....	**22.00**	20.00	19.50	15.50
Bessemer, Pittsburgh ...	**26.95**	24.95	23.45	16.95
Malleable Bess., Ch'go*	**24.00**	21.50	19.00	16.50
Gray forge, Pittsburgh.	**22.95**	20.95	19.95	15.20
L. S. charcoal, Chicago.	20.25	20.25	19.75	16.75
Rails, Billets, etc., Per Gross Ton:				
Bess. rails, heavy, at mill	33.00	33.00	33.00	28.00
O.-h. rails, heavy, at mill	35.00	35.00	35.00	30.00
Bess. billets, Pittsburgh.	50.00	50.00	45.00	25.00
O.-h. billets, Pittsburgh..	50.00	50.00	45.00	26.00
O.-h. sheet bars, P'gh....	50.00	50.00	45.00	27.00
Forging billets, base, P'gh	**75.00**	73.00	69.00	42.00
O.-h. billets, Phila.....	50.00	50.00	48.00	32.00
Wire rods, Pittsburgh....	**60.00**	55.00	55.00	35.00
Finished Iron and Steel,				
Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Iron bars, Philadelphia..	2.659	2.659	2.659	1.659
Iron bars, Pittsburgh....	**2.85**	2.75	2.60	1.50
Iron bars, Chicago.....	**2.40**	2.35	2.35	1.45
Steel bars, Pittsburgh....	2.75	2.75	2.75	1.50
Steel bars, New York....	2.919	2.919	2.919	1.669
Tank plates, Pittsburgh..	4.00	4.00	4.00	1.50
Tank plates, New York..	4.169	4.169	4.169	1.769
Beams, etc., Pittsburgh..	2.75	2.75	2.75	1.50
Beams, etc., New York..	2.869	2.869	2.869	1.669
Skelp, grooved steel, P'gh.	**2.70**	2.50	2.35	1.45
Skelp, sheared steel, P'gh.	**2.80**	2.60	2.45	1.50
Steel hoops, Pittsburgh..	3.00	3.00	3.00	1.75

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Sheets, Nails and Wire, Per Lb. to Large Buyers:	Nov. 1, 1916. Cents.	Oct. 25, 1916. Cents.	Oct. 4, 1916. Cents.	Nov. 3, 1915. Cents
Sheets, black, No. 28, P'gh	3.40	3.40	3.10	2.15
Sheets, galv., No. 28, P'gh	**4.90**	4.75	4.25	3.60
Wire nails, Pittsburgh...	2.70	2.70	2.60	1.85
Cut nails, Pittsburgh....	2.70	2.70	2.60	1.80
Fence wire, base, P'gh..	2.65	2.65	2.55	1.70
Barb wire, galv., P'gh..	3.55	3.55	3.45	2.70
Old Material, Per Gross Ton:				
Iron rails, Chicago.....	22.00	22.00	19.25	14.25
Iron rails, Philadelphia..	21.00	21.00	20.00	17.50
Carwheels, Chicago.....	**16.00**	14.50	11.75	12.50
Carwheels, Philadelphia..	**16.50**	16.00	15.50	13.50
Heavy steel scrap, P'gh.	19.00	19.00	17.50	15.00
Heavy steel scrap, Phila.	**16.50**	16.00	15.00	14.50
Heavy steel scrap, Ch'go.	**18.75**	17.75	16.25	12.50
No. 1 cast, Pittsburgh....	16.00	16.00	15.00	13.50
No. 1 cast, Philadelphia..	**16.75**	16.00	16.00	14.00
No. 1 cast, Ch'go (net ton)	14.75	14.75	12.50	11.75
No. 1 RR. wrot, Phila....	**23.00**	22.50	20.00	16.00
No. 1 RR. wrot, Ch'go (net)	**19.00**	18.00	16.75	14.25
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt...	**$7.50**	$7.00	$3.25	$2.25
Furnace coke, future....	**4.00**	3.75	3.00	2.35
Foundry coke, prompt...	**7.00**	5.00	3.25	2.75
Foundry coke, future....	4.50	4.50	3.75	2.60
Metals,				
Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York.	**29.00**	28.50	28.25	17.87½
Electrolytic copper, N. Y.	28.50	28.50	28.50	17.87½
Spelter, St. Louis.....	**10.37½**	10.00	9.50	14.75
Spelter, New York.....	**10.62½**	10.25	9.70	15.00
Lead, St. Louis.....	6.90	6.92½	6.85	4.80
Lead, New York.....	7.00	7.00	7.05	4.90
Tin, New York.....	**41.87½**	41.25	39.25	35.87½
Antimony (Asiatic), N. Y.	13.00	13.00	10.00	35.50
Tin plate, 100-lb. box, P'gh.	$5.75	$5.75	$5.75	$3.15

necessary, thus adding to their troubles in trying to supply cars to shippers.

Pig Iron.—Prices advanced sharply the past week, with predictions that Bessemer will reach $30 or higher; basic, $27 to $28, and No. 2 foundry, $25 to $26. Early last week, Bessemer iron sold rather freely at $24 to $25, and basic at $20, Valley furnace. In the last two or three days, there have been bona fide sales of Bessemer at $26 and even $26.50; basic at $22, with reports that $23 has been done, while No. 2 foundry has sold at $23 in fairly large lots and $24 in small lots, all at Valley furnace. The new demand for Bessemer and basic iron is heavy, and the available supply is light. There are export inquiries in this market for 40,000 to 50,000 tons of Bessemer iron, mostly for France, but some for Italy. Domestic buyers are rushing to cover before the market gets higher. We note a sale of 10,000 tons of Bessemer iron at $26, Valley furnace, for first half delivery, 2000 tons for first quarter, 1500 tons at $26.50 for first half and other smaller sales aggregating probably 4000 to 5000 tons, at $26 to $26.50, Valley furnace. We also note a sale of 50,000 tons of basic iron for delivery over all of 1917 at the prevailing market prices each month; that is, the average price of basic iron each month as determined by quotations in THE IRON AGE are to apply on each month's shipments. We also note a sale of 5000 to 6000 tons of basic at $22, Valley furnace, and there are quite reliable reports that $23, Valley, has been done on basic iron for first half. Two or three furnaces have had to close down for lack of coke, and this is increasing the shortage in supply of iron. There have been moderate sales of No. 2 foundry at $23, Valley furnace, one concern taking 2000 tons for first four months of next year, and there have been some smaller sales at $24. We now quote standard Bessemer iron at $26 to $26.50; basic, $22 to $23; malleable Bessemer, $23 to $24; gray forge, $22 to $23, and No. 2 foundry, $23 to $24, all at Valley furnace, the freight rate for delivery in the Pittsburgh and Cleveland districts being 95c.

[*By Telegraph, Nov.* 1.—W. P. Snyder & Co. report the average price of Bessemer pig iron in October, made up from sales of 1000 tons or more, was $23.65, Valley furnace, an advance over the September average of $1.72. On basic iron the October average was $20.31. Valley furnace, an advance over the September average of $1.68.]

Billets and Sheet Bars.—It is still a question of where to find steel, the price being of minor importance in transactions. Reports are that an inquiry from the Allies has reached this country for an almost unbelievable amount of forging billets, and steel plants that make this grade of steel are being importuned to take as much of the order as they possibly can, and practically at their own price. Nothing official regarding this reported inquiry can be learned here, but it is the subject of a good deal of gossip in the local trade. It is not believed that any outside soft Bessemer or open-hearth billets or sheet bars could be picked up to-day at less than $55 per ton, and reports are that $60 has been done. All the steel mills are falling down badly on deliveries of steel, and the sheet and tin-plate mills are having their output cut down materially on account of not getting steel as fast as they need it. The export demand is still heavy, but local mills are not paying much attention to this, as they cannot take care of the domestic demand. Prices on forging billets are steadily going up, and we note a sale of 200 tons of high carbon billets at 4c. per pound, or practically $90 per ton, f.o.b., maker's mill. We have not changed our quotations this week, but it is doubtful if any soft Bessemer or open-hearth steel could be bought from any source to-day for reasonably early delivery at less than $55, at maker's mill. We quote base sizes and base carbons of open-hearth billets and sheet bars at $50 to $55 at mill, Youngstown or Pittsburgh, and forging billets at $75 for sizes up to but not including 10 x 10 in., and for carbons up to 0.25.

Ferroalloys.—The new demand for ferromanganese is only fair, consumers evidently being covered for some time ahead and, in fact, it is said that some of the large steel mills are offering now and then small lots of 80 per cent ferromanganese for reasonably prompt shipment, desiring to take advantage of the very high

prices ruling. The local producer is also offering ferromanganese in the open market to some extent. We quote 80 per cent English at about $164, seaboard, but domestic 80 per cent is offered as low as $160 at furnace. We quote 18 to 22 per cent spiegeleisen at $50 to $55, and 25 to 30 per cent at $65 to $75, delivered. Nearly all consumers of ferrosilicon are covered for first half of 1917 and some for the entire year, so that the new demand is only fair. We quote 50 per cent ferrosilicon for delivery next year in lots up to 100 tons at $100; 100 tons to 600 tons, $99, and over 600 tons, $98, all per gross ton, f.o.b., Pittsburgh. We quote 9 per cent at $32; 10 per cent, $33; 11 per cent, $34; 12 per cent, $35; 13 per cent, $36.50; 14 per cent, $38.50; 15 per cent, $40.50, and 16 per cent, $43. We quote 7 per cent silvery at $26.50; 8 per cent, $27; 9 per cent, $27.50; 10 per cent, $28; 11 per cent, $29, and 12 per cent, $30. These prices are f.o.b., furnace, Jackson or New Straitsville, Ohio, and Ashland, Ky., all of which have a freight rate of $2 per gross ton to the Pittsburgh district.

Steel Rails.—Some fairly large orders for standard sections are being placed with the local producer for delivery at its convenience, which probably would not be before the last quarter of 1917. Occasionally a small order for 80, 90 or 100 lb. rails can be slipped in when the mill is rolling these sections, so that on some of these orders probably earlier delivery than second half of next year will be made. It is claimed that two or three of the leading railroads will have to buy considerably more quantities of standard sections for next year delivery, and are now trying to get on the rolling schedules of the mills with these orders. The demand for light rails is more active than for some time, running from 4000 to 5000 tons per week for new light rails. The demand for rerolled rails is also heavy and considerable export shipments are being made. We quote 25 to 45 lb. sections at $47; 16 and 20 lb., $48; 12 and 14 lb., $49, and 8 and 10 lb., $50, in carload lots, f.o.b. at mill, the usual extras being charged for less than carload lots. We quote standard section rails of Bessemer stock at $33 and of open-hearth $35, per gross ton, Pittsburgh.

Plates.—Mills that can make deliveries in second and third quarters of next year are quoting as high as 4.50c. on sheared plates and have taken orders at this price. It is said active inquiries are in the market for 20,000 to 25,000 steel cars and that more are coming. The Erie has placed 500 steel gondolas with the Pressed Steel Car Company. The Southern is in the market for 1000 to 1500 and the Burlington for 1500 box cars. Under present conditions it is difficult to quote the plate market, but in a general way it can be said the prices on ¼-in. and heavier sheared plates range all the way from 3.25c. at mill, which is the Carnegie Steel Company's new price with no promise whatever of delivery, up to 4.50c. quoted by mills that promise deliveries in second or third quarter of 1917. On plates for delivery in two to four months, prices range from 5c. to 5.50c., depending on the size of the order and the promise of deliveries that the buyer is willing to accept from the mill.

Structural Material.—The new inquiry continues fairly active. The McClintic-Marshall Company has taken 5000 tons for extensions to the open-hearth buildings of the Youngstown Sheet & Tube Company, and the American Bridge Company has taken 250 tons for a steel building for a pulverizing coal plant for the American Steel & Wire Company, Donora, Pa. The Carnegie Steel Company's price on plain material is 2.80c. at mill, with no promise as to deliveries, while another leading maker is quoting 2.85c. up to 3c. at mill for delivery in second and third quarters of 1917. We quote beams and channels up to 15 in. at 2.80c. to 3c. at mill, depending on deliveries, while small lots from stock for fairly prompt shipment are quoted at 3.25c. to 3.50c., Pittsburgh.

Sheets.—Effective Thursday, Oct. 26, the American Sheet & Tin Plate Company advanced its price on galvanized sheets to the basis of 5c. at mill for No. 28. This company is confining its sales to first quarter delivery, and has but limited amount to sell, all of which has been allotted to its district sales offices. The new demand for all grades of sheets is enormously heavy, while the acute car shortage is interfering, not only with shipments but also with production, the sheet mills having trouble in getting deliveries of steel promptly. The export demand is also heavy, and in sheets, as in tin plate, it is now beginning to look as though there may possibly be a shortage in the supply in the first half of 1917. One leading sheet mill in the Youngstown district was down nearly a whole week recently waiting for sheet bars to arrive. The fact that nearly all the mills are now quoting 5c. for galvanized sheets will probably prevent some litigation over former contracts for galvanized sheets made at 5c., against which certain buyers refused to specify when prices went considerably lower. Minimum prices now ruling are as follows: Blue annealed sheets, Nos. 8 to 8, 3.40c. to 3.50c.; box annealed, one pass cold-rolled sheets, 3.40c. to 3.50c.; No. 28 galvanized, 4.90c. to 5c., and tin-mill black plate No. 28, 3.30c. to 3.40c., all f.o.b. Pittsburgh.

Tin Plate.—The market continues very strong. Practically the entire output of the mills for the first half of 1917 is now under contract, and a very large quantity has been sold for shipment in the second half, the price to be as agreed upon hereafter. The export demand continues heavy, but some domestic mills are refusing to quote on export inquiries, stating they will not have enough tin plate to supply their domestic trade. With the constant advances in prices of raw materials and the growing shortage in supply of labor, it would not be surprising if prices on tin plate for the second half of 1917 would be $1 a box or more higher than for the first half. We quote bright plate, 14 x 20, at $5.75 to $6 per base box, f.o.b. Pittsburgh, for delivery in the first half of 1917. We quote terne plate, 200-lb. package, carrying 8 lb. of coating, at $9.50 per package; 10-lb. I.C., $9.80; 12-lb. I.C., $10.75; 15-lb. I.C., $11.15; 20-lb. I.C., $11.85; 25-lb. I.C., $12.65; 30-lb. I.C., $13.45; 35-lb. I.C., $14.30; 40-lb. I.C., $15.10, all f.o.b. Pittsburgh

Shafting.—Additional contracts for large quantities of shafting for delivery in the first quarter and first half of 1917 are still being made, mostly with automobile builders whose purchases for first half delivery are much larger than for any previous six months' shipments The implement makers and screw stock machine trade are also buying heavily, and a very large quantity of shafting is now on the books of the mills for first half delivery. Makers are catching up on shipments to some extent, and from one or two mills deliveries in eight to ten weeks can now be obtained. We quote cold-rolled shafting at 20 to 15 per cent off in carload lots for delivery in the last quarter of this year and first quarter of 1917, and 10 per cent off in less than carload lots, f.o.b. Pittsburgh, freight added to point of delivery.

Wire Products.—Mills report that both the export and domestic demand for wire and wire nails is extremely heavy and the entire output for the remainder of this year is sold up, with some contracts placed for delivery in the first quarter. There is a decided scarcity in the supply of wire nails, and the car shortage is holding back shipments to a considerable extent. If present conditions continue, it is very probable there will shortly be another advance in prices. It is said the inquiry from France for 30,000 to 35,000 tons of plain, galvanized and varnished wire has not yet been placed. Premiums of 10c. to 15c. per keg on prompt shipments of wire nails could likely be obtained. Prices are as follows: Wire nails, $2.70, base, per keg; galvanized, 1 in. and longer, including large head barbed roofing nails, taking an advance over this price of $2, and shorter than 1 in., $2.50. Bright basic wire is $2.75 per 100 lb.; annealed fence wire, Nos. 6 to 9, $2.65; galvanized wire, $3.35; galvanized barb wire and fence staples, $3.55; painted barb wire, $2.85; polished fence staples, $2.85; cement-coated nails, $2.60, base, these prices being subject to the usual advances for the smaller trade, all f.o.b. Pittsburgh, freight added to point of delivery, terms 60 days net, less 2 per cent off for cash in 10 days. Discounts on woven wire fencing are 58 per cent off list for carload lots, 57 per cent for 1000-rod lots and 56 per cent for small lots, f.o.b. Pittsburgh.

Railroad Spikes and Track Bolts.—The new demand for railroad spikes is dull and several makers are think-

ing seriously of shutting down their spike departments and diverting their steel to other products. The Nickel Plate is reported to have placed an order for 2000 kegs. The new demand for track bolts is only fair, but prices are firm. We quote track bolts with square nuts at 4.50c. to 4.75c. to railroads and 5c. to 5.25c. in small lots to jobbers, base. Track bolts with hexagon nuts take the usual advance of 15c. per 100 lb. Prices on spikes are as follows:

Standard railroad spikes, 4½ x 9/16 in. and larger, $2.65 to $2.75; railroad spikes, ½ to 7/16 in., $2.75 base; railroad spikes, ⅜ in. and 5/16 in., $3.05 base; boat spikes, $2.80 base, all per 100 lb., f.o.b. Pittsburgh.

Rivets.—Consumers are covering their needs in rivets for first quarter and first half of 1917, and it is said at full prices. The export demand is heavy, one local maker shipping out recently several carloads for India and one for South America. Makers are sold up over the next three or four months, but say they are having much trouble in getting deliveries of steel, and this is holding down their output. Makers' prices are firm and are as follows: Buttonhead structural rivets, ½ in. in diameter and larger, $4 per 100 lb., base, and conehead boiler rivets, same sizes, $4.10 per 100 lb., base, f.o.b. Pittsburgh. Terms are 30 days net, or one-half of 1 per cent for cash in 10 days.

Iron and Steel Bars.—The Carnegie Steel Company's price on steel bars is 2.70c. at mill, with no promise as to delivery. The implement trade is now reported to be well covered over the first half of next year, and specifications against contracts for steel bars are heavy. The demand from carbuilders is more active than for a long time, and for reinforcing steel bars is especially heavy. Reports are that active export inquiries are in the market for 200,000 tons or more of steel rounds for the Allies for delivery late in 1917. One leading maker that can promise delivery in second and third quarters of 1917 is quoting steel bars at 2.75c. to 2.85c. at mill. We therefore quote steel bars at 2.70c. at mill, for very indefinite delivery, and 2.75c. to 2.85c. for specified delivery in second or third quarters. Iron bars have advanced, and we now quote refined iron bars at 2.85c. to 2.90c., and railroad test bars at 2.90c. to 3c., f.o.b. Pittsburgh.

Cold-Rolled Strip Steel.—A very large quantity of this material has been placed under contract with the makers for delivery in first quarter and first half of 1917 at $6.25 to $6.50 per 100 lb., f.o.b. Pittsburgh. The export demand continues heavy, but local makers say they are not paying much attention to export inquiry, as it will require their entire output the next six or eight months to take care of their domestic trade. We quote on contracts for first quarter delivery at $6.25 to $6.50 and on small lots for shipment this year from $6.75 to $7. Terms are 30 days net, less 2 per cent off for cash in 10 days, delivered in quantities of 300 lb. or more when specified for at one time.

Merchant Steel.—Prices are likely to be much higher in the very near future, and in fact one leading mill is said to have advanced all its prices 10 per cent or more. The market on semi-finished steel is steadily going up, and in addition deliveries by the mills are very slow. Prices in effect at this writing for small lots, but which may be advanced at any time, are as follows: Iron-finished tire, ½ x 1½ in. and larger, 2.75c., base; under ½ x 1½ in., 2.85c.; planished tire, 2.90c.; smooth channel tire, ¾ to ⅞ and 1 in., 3c. to 3.10c.; 1⅛ in. and larger, 3.10c.; toe calk, 3.25c. to 3.50c., base; flat sleigh shoe, 2.75c.; concave and convex, 2.85c.; cutter shoes, tapered or bent, 3.50c. to 3.75c.; spring steel, 4c. to 4.10c.; machinery steel, smooth finished, 3.10c. to 3.25c., all f.o.b. at mill.

Nuts and Bolts.—With the recent advance in prices of steel bars, an advance in prices of nuts and bolts is expected at any time. Makers report the new demand active and large contracts have been placed by consumers for delivery over first half of next year at full prices. The deliveries of steel by the mills are still slow and there is a keen shortage in labor supply, keeping down the output to a considerable extent. Discounts are as follows, delivered in lots of 300 lb. or more, where the actual freight rate does not exceed 20c. per 100 lb., terms 30 days net, or 1 per cent for cash in 10 days.

Carriage bolts, small, rolled thread, 50 and 5 per cent; small, cut thread, 40, 10 and 5 per cent; large, 35 and 5 per cent.

Machine bolts, h. p. nuts, small, rolled thread, 50 and 10 per cent; small, cut thread, 50 per cent; large, 40 and 5 per cent.

Machine bolts, c. p. c. and t. nuts, small, 40 and 10 per cent; large, 35 per cent. Blank bolts, 40 and 5 per cent. Bolt ends, h. p. nuts, 40 and 5 per cent; with c. p. nuts, 35 per cent. Rough stud bolts, 15 per cent. Lag screws (cone or gimlet point), 50 and 5 per cent.

Forged set screws and tap bolts, 10 per cent. Cup and round point set screws, case-hardened, 60 per cent. Square or hexagon head cap screws, 55 per cent. Flat, button, round or fillister head cap screws, 30 per cent.

Nuts, h. p. sq., tapped or blank, $2.70 off list; hex., $2.70 off. Nuts, c. p. c. and t. sq., tapped or blank, $2.40 off; hex., $2.80 off. Semi-finished hex. nuts, 60 and 5 per cent. Finished and case-hardened nuts, 60 and 5 per cent.

Rivets, 7/16 in. in diameter and smaller, 45, 10 and 5 per cent.

Wire Rods.—Consumers are having trouble in finding mills that will take their orders for wire rods, the supply not being large enough to meet the demand. Recently a sale of 500 tons of soft Bessemer No. 5 rods for export to Canada was made at $63, maker's mill. It is said that high carbon rods of special quality have sold at $75 to $80 at mill. We quote soft Bessemer, open-hearth and chain rods from $60 to $65 per gross ton, f.o.b. Pittsburgh.

Hoops and Bands.—The nominal price of the Carnegie Steel Company on steel hoops is 3c. and on steel bands, carrying steel bar extras, 2.70c., but with no promises as to delivery. Other makers are quoting steel hoops as high as 3.25c. and steel bands at 3c. for specified delivery.

Wrought Pipe.—Several of the leading pipe mills state that up to Nov. 1 orders entered on their books for tubular goods were more than double those of the entire year of 1915. The mills report that on lap-weld pipe and oil-country goods they are booked up solidly to July 1 or longer, but on butt-weld sizes can make deliveries in four to six weeks. Inquiries are in the market for large quantities of line pipe, some of which are likely to be placed in the near future. Discounts given on another page are firmly held, and a general advance in prices on black iron and steel pipe, and possibly also on galvanized, may be announced at any time.

Boiler Tubes.—The demand for locomotive and merchant tubes is still very heavy and local mills report they are booked up for their entire output for the next 10 to 12 months. On seamless steel tubing the two local producers say their entire output for all of 1917 is under contract. Prices under these conditions are naturally very strong and may be advanced at any time. Discounts are given on another page.

Coke.—The local market on prompt coke is much stronger. High-grade furnace coke for prompt shipment has sold in the last day or two at $7.50 per net ton at oven, while some makers are quoting as high as $8. Large contracts for next year have been closed, some consumers having covered their entire needs for first half, or all of 1917. Others have only partly covered, and a few consumers have not bought at all. We note one contract for 22,500 tons of high-grade Connellsville coke per month for first half at $3.75; another for 10,000 tons per month for all of 1917 at the same price; an Eastern contract for 9500 tons per month at $3.75, and a fourth contract for 7000 tons per month at the same figure. Some sellers are asking $4 and higher on contracts, but so far this price has not been paid, $3.75 per net ton at oven having been top of the market. The high price of coal and the shortage in labor and cars are mainly responsible for the very high prices ruling on coke. Some former producers of coke are shipping their coal, while the shortage in cars is holding back shipments of coke, and the scarcity of labor is keeping down output materially. At some large coke plants in the Connellsville region where pay day falls on Saturday, it is usually about Wednesday of the next week before the full force of men returns to work. Foundry coke is active. We quote best grades of Connellsville furnace coke for prompt shipment at

$7 to $7.50 per net ton at oven, and on contracts at $3.75 to $4. We quote 72-hr. foundry coke of best grades all the way from $6 to $7 per net ton for spot shipment, and on contracts from $4 to $4.50, while some makers are asking $5 at oven. The Connellsville *Courier* gives the output of coke in the upper and lower Connellsville regions for the week ended Oct. 21 as 398,096 net tons, a decrease over the previous week of 6750 tons.

Old Material.—The scrap market is stronger in tone. While new buying by consumers is not heavy, indications point to higher prices in the near future. Two items that are lagging are turnings and borings. Ordinarily blast furnaces would be buying large quantities of turnings for charging purposes, but just now it is a question of getting out as large an output as possible, and the matter of saving $1 to $2 a ton on the raw material is not considered. There is a scarcity in the supply of rerolling rails and low phosphorus melting stock, and prices are up fully $1 a ton. Some large consumers that have not bought any scrap to speak of for several months are expected to be in the market in the near future. In the Youngstown district one leading consumer has bought quite heavily of steel scrap recently, and another has been buying large quantities of special grade melting scrap to go into high carbon billets, and has paid as high as $20 or more for it. The minimum of the market on selected heavy steel scrap is $19, but some dealers are asking higher prices. We note sales of 200 tons of turnings at $7.50; 400 tons of borings at $9.25 to $9.50; 1500 tons of heavy steel scrap, in the Youngstown district early last week at $18.50; 2000 tons sold later at $19, and 1200 to 1500 tons of low phosphorus melting stock at about $22.50, delivered. Prices now being quoted by dealers for delivery in Pittsburgh and points that take the same rates of freight, per gross ton, are as follows:

Heavy steel melting scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh, delivered	$19.00 to $19.50
No. 1 foundry cast	16.00 to 16.25
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	20.50 to 21.00
Hydraulic compressed sheet scrap	15.00 to 15.25
Bundled sheet scrap, sides and ends, f.o.b. consumers' mills, Pittsburgh district	12.00 to 12.25
Bundled sheet stamping scrap	11.00 to 11.25
No. 1 railroad malleable stock	15.75 to 16.00
Railroad grate bars	11.50 to 11.75
Low phosphorus melting stock	22.00 to 22.50
Iron car axles	38.00 to 39.00
Steel car axles	38.00 to 39.00
Locomotive axles, steel	39.00 to 40.00
No. 1 busheling scrap	14.50 to 15.00
Machine-shop turnings	7.50 to 7.75
Old carwheels	15.00 to 16.00
Cast-iron borings	9.00 to 9.25
*Sheet bar crop ends	19.00 to 19.50
No. 1 railroad wrought scrap	19.50 to 20.00
Heavy steel axle turnings	11.00 to 11.50
Heavy breakable cast scrap	14.00 to 14.50

*Shipping point.

Chicago

CHICAGO, ILL., Oct. 31, 1916.—(*By Wire.*)

The advance in pig-iron prices has not yet been checked nor is there evidence as to when it will be. At Chicago $24 is being asked for foundry malleable and basic irons and $30 for standard Bessemer. The minimum quotation of Southern furnaces is up another dollar to the basis of $17, Birmingham. The buying of malleable Bessemer and of steel-making iron last week included several large lots, and the leading interest reports that it is very close to the time when it will have no iron to sell. Some of the charcoal producers are withdrawing from the market. The buying of equipment by the railroads included orders last week for more than 5500 cars, for which at least 50,000 tons of steel has been booked by the mills; several small lots of rails and between 11,000 and 12,000 tons of tie-plates, of which the largest order—8000 tons—was placed by the Atlantic Coast Line at Chicago. In addition to the cars bought there is on the eve of being placed an additional 10,000. There is also a very general inquiry from the railroads for fastenings for delivery in the latter part of next year. In connection with the booking of railroad orders, it is of interest to note that the recent large Russian order for cars has been canceled. The spectacular advance in the prices of some of the products which had lagged is spreading over the entire list of materials and on Monday the leading interest announced an increase of $2 per ton in the price of bars and shapes and $5 per ton for plates. The prices of old material are continuing their advance, increases of from 50c. to $1.50 per ton being reported for nearly all classes of scrap. A large interest came into the market for steel scrap and bought practically all that sellers were willing to undertake to deliver.

Rails and Track Supplies.—The inquiry of the Great Northern for 30,000 to 40,000 tons of rails for 1918 delivery has not been closed and remains the most important now open for consideration. There is also a general inquiry for track fastenings, while sales of tie-plates last week were important. Among these the purchase of 8000 tons of steel tie-plates by the Atlantic Coast Line at Chicago is particularly significant of the abnormal conditions existing. Quotations are as follows: Standard railroad spikes, 2.75c., base; track bolts with square nuts, 3.25c. to 3.50c., base, all in carload lots, Chicago; tie-plates, $52 to $54, f.o.b., mill, net ton; standard section Bessemer rails, Chicago, $33, base; open-hearth, $35; light rails, 25 to 45 lb., $40; 16 to 20 lb., $41; 12 lb., $42; 8 lb., $43; angle bars, 2c., Chicago.

(*By Mail*)

Pig Iron.—The price of standard No. 2 Northern foundry iron, malleable Bessemer and basic has been advanced to $24 at Chicago furnace and quotations are out on high phosphorus Northern foundry iron, silicon 1.75 to 2.25 per cent, on the basis of $18.50, Birmingham. The advance in the price of Southern iron has not been so rapid, as $17, Birmingham, can still be done for No. 2, while iron running 3 per cent in silicon has been sold at the equivalent of $18, Birmingham. Other sales of Southern high silicon iron have been made, however, at prices relatively higher, one quotation for 6 per cent silicon iron approximating $30, Chicago. For standard Bessemer iron, as high as $30, Chicago, is being asked, sales last week being at prices ranging upward from $26. There has been very little abatement of the demand for iron, though the interest in spot iron has not materialized to the extent forecast by the inquiry of a week ago. There is, however, a disposition on the part of a number of melters within the Chicago switching district to anticipate first quarter contracts and the total of advanced shipments is reported as steadily increasing. New inquiry for malleable Bessemer is noted and the local malleable foundry which was in the market for several thousand tons is reported to have closed for a large part, if not all, of the iron desired. The principal seller in this market is rapidly reducing the amount of iron it has remaining for sale in the first half in both foundry and steel-making grades. In other hands there is a round tonnage of standard Bessemer still available. Sales of charcoal iron have been sufficiently heavy to cause at least two of the principal producers practically to withdraw from the market. For Lake Superior charcoal iron we quote delivery prices at Chicago to include a freight rate of $1.75. The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace, and do not include a switching charge averaging 50c. per ton:

Lake Superior charcoal, Nos. 2 to 5	$20.25 to $20.75
Lake Superior charcoal, No. 1	20.75 to 21.25
Lake Superior charcoal, No. 6 and Scotch	21.25 to 21.75
Northern coke foundry, No. 1	24.50
Northern coke foundry, No. 2	24.00
Northern coke foundry, No. 3	23.50
Northern high phosphorus foundry	22.50 to 23.00
Southern coke, No. 1 f'dry and 1 soft	21.50 to 22.00
Southern coke, No. 2 f'dry and 2 soft	21.00 to 21.50
Malleable Bessemer	24.00
Basic	24.00
Low phosphorus	40.00
Silvery, 8 per cent	34.50 to 35.50
Bessemer ferrosilicon, 10 per cent	35.50

Plates.—The leading mill to-day advanced its price for plates, for such delivery as it may be able to make in 1917, to 3.25c., Pittsburgh, an advance of $5 per ton.

The demand for prompt shipment plates is unceasing and sales at prices ranging from 3.50c. to 4.50c., depending upon the widths of the plates desired, are being regularly made. The demand for plates for both commercial and naval shipbuilding is so great as to bring a steady stream of inquiry from the East to Western mills. We quote for Chicago delivery of plates from mill, at its convenience, 3.439c. For prompt shipment we quote 3.539c. to 3.939c. in widths up to 72 in., and for wide plates 4.189c. to 4.689c.

We quote for Chicago delivery of plates from jobbers' stocks, 3.75c.

Sheets.—Sellers of sheets do not report a large and insistent volume of inquiry as uniformly as a week ago. Some of the mills still have under negotiation more business than can be taken care of within the delivery period required, while other mills, after the heavy selling of the past few weeks, report some falling off in demand. We quote, for Chicago delivery, blue annealed, No. 16 and heavier, 3.289c. to 3.439c.; box annealed, No. 17 and lighter, 3.589c. to 3.689c.; No. 28 galvanized, 4.689c. to 5c.

We quote for Chicago delivery of sheets out of stock, minimum prices applying on bundles of 25 or more, as follows: No. 10 blue annealed, 3.40c.; No. 28 black, 3.80c. to 3.90c.; No. 28 galvanized, 5.15c. to 5.25c.

Structural Material.—The large number of orders for equipment which the railroads are placing suggests that better delivery promises are being made than the raw material situation would seem to warrant, but it is well known that the car shops have for some time been in a position to build a much larger number of cars than they have been able to secure. Last week orders for some 5500 cars were placed, in which were included 2000 box for the Baltimore & Ohio, 1000 box for the Erie, 1000 gondolas for the New York Central Lines, 500 refrigerator for Armour & Co., 500 box for the San Pedro, Los Angeles & Salt Lake City, and 250 refrigerators each for Morris & Co. and Wilson & Co., Chicago packers. Inquiry embraces an even larger number, including 2000 hoppers for the Chesapeake & Ohio, 1500 box for the Chicago, Burlington & Quincy, 1000 hoppers for the Baltimore & Ohio, 2000 gondolas, 600 ballast and 400 general service box for the Illinois Central, 1000 stock for the Missouri, Kansas & Texas and 1000 box for the Pere Marquette. Among the contracts for fabricated steel placed last week only one exceeded 300 tons, that being for 370 tons to be furnished by the Virginia Bridge & Iron Company for an approach to the Memphis bridge. Other contracts placed aggregated about 700 tons. The price of structural steel from mill for future delivery contracts has been advanced $2 per ton and we quote for Chicago delivery 2.989c.

We quote for Chicago delivery of structural steel out of jobbers' stocks, 3.25c.

Bars.—The minimum price of 2.60c., Pittsburgh, for mild steel bars has been advanced $2 per ton. This is still $3 per ton below the prices being asked for prompt shipment bars, for which there is a continuous but not large demand. There is a limited selling of iron bars, with prices ranging from 2.40c. to 2.50c., Chicago, but most of the users of this material are now under contract for the first quarter and first half. We quote mill shipment, Chicago, as follows: Bar iron, 2.40c. to 2.50c.; soft steel bars, 2.889c.; hard steel bars, 2.50c.; shafting, in carloads, 20 per cent off; less than carloads, 15 per cent off.

We quote store prices for Chicago delivery: Soft steel bars, 3.25c.; bar iron, 3.25c.; reinforcing bars, 3.25c. base with 5c. extra for twisting in sizes ½ in. and over and usual card extras for smaller sizes; shafting net list.

Rivets and Bolts.—There is a fair aggregate of inquiry for bolts and nuts in the market, largely from the railroads, but also from the hardware jobbing trade. In connection with current rivet sales, irregularities in price are still reported. We quote as follows: Carriage bolts up to ⅞ x 6 in., rolled thread, 50-5; cut thread, 40-10-2½; larger sizes, 35-2½, machine bolts up to ⅞ x 4 in., rolled thread, with hot pressed square nuts, 50-10; cut thread, 50; large size, 40-5; gimlet-point coach screws, 50-5; hot pressed nuts, square, $2.70 off per 100 lb.; hexagon, $2.70 off. Structural rivets, ¾ to 1¼ in., 4c. to 4.15c., base, Chicago, in carload lots; boiler rivets, 10c. additional.

Store prices for rivets have been advanced and we quote as follows: Structural rivets, 4.25c.; boiler rivets, 4.35c.; machine bolts up to ⅞ x 4 in., 50; larger sizes, 40-5; carriage bolts up to ⅞ x 6 in., 40-10; larger sizes, 35-5; hot pressed nuts, square, $3, and hexagon, $3 off per 100 lb.; lag screws, 50-5.

Cast-Iron Pipe.—Business in the West is of minor importance, the only letting of any size being the division of 1400 tons at Kansas City, Mo., equally to the leading interest and the American Cast Iron Pipe Company. We quote as follows, per net ton, Chicago: Water pipe, 4 in., $34.50; 6 in. and larger, $31.50, with $1 extra for Class A water pipe and gas pipe.

Wire Products.—An advance in the discount on fence to the basis of 58 per cent has been announced. Floating inquiry for barb wire for export runs into extravagant quantities, but is bringing out few quotations. Many domestic manufacturers are still in need of wire in excess of what they are able to secure and many interesting pledges of future orders are being made in the endeavor to secure accommodation at the present time. We quote as follows per 100 lb.: Plain wire, Nos. 6 to 9, base, $2.939; wire nails, $2.889; painted barb wire, $3.039; galvanized barb wire, $3.739; polished staples, $3.039; galvanized staples, $3.739; all Chicago.

Old Material.—Prices of scrap have advanced by leaps and bounds in the last week, following heavy buying of steel scrap by a large local consumer. In connection with this buying, a price of $17.50 was established for shoveling steel and $18.75 for heavy melting steel. There has also been very general buying of all other grades of old material, though the limited amount of scrap available in the market has restricted the quantities purchased. Low phosphorus scrap in particular has advanced sharply and steel knuckles, couplers and springs are roughly quoted as worth a cent per pound. Reports are current of sales of steel car axles at prices as high as $40, and carwheels are being quoted by some of the dealers on the basis of $16 to $16.50, Chicago. The railroads are still admittedly making little effort to gather up scrap for the reason that every available car is needed for other service, and railroad offerings continue light. Lists issued last week include 3500 tons from the Chicago & Northwestern, 4000 tons from the Santa Fe, 1100 tons from George W. Jennings, and small lists from the Chicago & Alton and Monon railroads. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton	
Old iron rails	$22.00 to $22.50
Relaying rails	21.00 to 22.00
Old carwheels	16.00 to 16.50
Old steel rails, rerolling	21.00 to 21.50
Old steel rails, less than 3 ft.	20.50 to 21.00
Heavy melting steel scrap	18.75 to 19.00
Frogs, switches and guards, cut apart	18.75 to 19.00
Shoveling steel	17.50 to 17.75
Steel axle turnings	10.00 to 10.50
Per Net Ton	
Iron angles and splice bars	$22.50 to $23.00
Iron arch bars and transoms	24.50 to 25.00
Steel angle bars	18.50 to 19.00
Iron car axles	33.00 to 34.00
Steel car axles	37.50 to 38.00
No. 1 railroad wrought	19.00 to 19.50
No. 2 railroad wrought	18.00 to 18.50
Cut forge	18.00 to 18.50
Pipes and flues	13.50 to 14.00
No. 1 busheling	15.50 to 16.00
No. 2 busheling	11.00 to 11.50
Steel knuckles and couplers	18.50 to 19.00
Steel springs	19.00 to 19.50
No. 1 boilers, cut to sheets and rings	12.25 to 12.75
Boiler punchings	15.50 to 16.00
Locomotive tires, smooth	22.75 to 23.25
Machine-shop turnings	6.50 to 7.00
Cast borings	7.25 to 7.75
No. 1 cast scrap	14.75 to 15.25
Stove plate and light cast scrap	11.25 to 11.75
Grate bars	11.25 to 11.75
Brake shoes	11.25 to 11.75
Railroad malleable	14.00 to 14.50
Agricultural malleable	12.00 to 12.50

The Bilrowe Alloys Company, Tacoma, Wash., manufacturer of ferrotungsten, ferromanganese and other alloys, plans immediate extensions to its plant to care for increasing business. It has recently closed contracts with Eastern steel manufacturers which call for prompt delivery.

Philadelphia

PHILADELPHIA, PA., Oct. 31, 1916.

Early this week the leading producer of Virginia pig iron withdrew from the market, but prior thereto booked an enormous tonnage at around $21.25, delivered. Eastern Pennsylvania makers have advanced their quotations, but even at the higher levels are reluctant to sell while the coke market is in its present upset condition. Several thousand tons of Virginia basic have been taken by a Lebanon interest at $19, furnace, or $21.50, delivered. An equal tonnage is understood to have commanded $22, delivered. Railroads and car and ship builders are seeking to cover their future needs of plates, the quotations for which are unchanged. Billets and sheets are stronger. The coke situation continues a source of worriment and uncertainty, with prices higher or at least undiminished. Rolling-mill grades of old material are in active demand and stronger. The entire scrap market has a better tone, in large part because Western points are drawing on the East for material. So far, local mills have not shown interest in heavy melting steel; meanwhile it is gaining strength.

Pig Iron.—The leading producer of Virginia iron has withdrawn from the market for any delivery, making the second Virginia maker which is not selling. Eastern Pennsylvania furnaces are asking higher prices, and most of them are not anxious to sell at the advances. The situation caused great activity in Virginia iron last week, but the withdrawal of the principal maker on Monday of this week called a halt in buying. The extent to which the purchasing referred to exceeded that for the products of other districts is illustrated by the case of one seller who in the week placed 11,000 tons, all but 1000 tons of which will be shipped from Virginia furnaces. Most of the buying was on the basis of $18.50, furnace, or $21.25, Philadelphia, for deliveries running well into next year. Virginia producers who still have iron to offer are quoting $20 to $20.50, furnace, for No. 2 X, to which must be added a freight rate of $2.75 for Philadelphia delivery. A moderate-sized lot of eastern Pennsylvania No. 2 plain was taken at $22.75, furnace, or $23.96, delivered. For one brand of Pennsylvania No. 2 X, $23.50, furnace, is quoted, making the delivered price $24.35. Another eastern Pennsylvania brand is held at $23, furnace, but quotations are given most reluctantly. The delivered price in this case is $23.79. Buffalo No. 2 X is quoted at $25, which, with a freight rate of $2.58, removes it as a factor in this market. Lake Superior charcoal iron is higher at about $23.84, Buffalo, for the less expensive grades. The subsidiary of a shipbuilding company is taking bids on 3000 tons of foundry iron for first half delivery. The Pennsylvania Railroad's total purchases in the past 10 days aggregate 8000 to 9000 tons of miscellaneous grades, including charcoal iron, for delivery at Altoona in the first half. A Lebanon steel company closed for 15,000 tons of basic, for about half of which it paid $21.50, delivered, or $19, furnace, for Virginia iron. Standard low phosphorus is unchanged at $40 to $42, delivered, but is less active, both because of the high price and the fact that the producers have comparatively little to sell for the next six months. Southern iron is quoted at $16, Birmingham, but the car shortage practically precludes any coming here. Quotations for standard brands delivered in buyers' yards, prompt shipment, range about as follows:

Eastern Pa. No. 2 X foundry	$22.50 to $23.50
Eastern Pa. No. 2 plain	22.00 to 23.00
Virginia No. 2 X foundry	22.75
Virginia No. 2 plain	22.50
Gray forge	21.00
Basic	21.50 to 22.00
Standard low phosphorus	40.00 to 42.00

Iron Ore.—Arrivals of iron ore at this port in the week ended Oct. 28 consisted of 6474 tons from Sweden and 7600 tons from Cuba.

Ferroalloys.—English 80 per cent ferromanganese, first half delivery, is quoted at $165, seaboard. The report is persistent that domestic makers have stiffened their quotation, but on the other hand the sellers of imported material continue to encounter concessions. Last week 500 tons of English ferromanganese arrived here. The quotation for 50 per cent ferrosilicon is $100, Pittsburgh, with premiums asked for prompt deliveries or small quantities. Bessemer, 11 per cent, is quoted at $38.44. A large steel company is in the market for 3000 to 4000 tons of Bessemer and non-Bessemer ferrosilicon. Spiegeleisen, 20 per cent, is quoted at $45.50, furnace.

Fluorspar.—There is a good demand for this material, with some of the sellers not in a position to quote. For washed gravel, $10, mine, is asked, and for No. 1 lump, $12.50.

Plates.—Atlantic coast shipyards are seeking to protect themselves on plates, and the railroads and carbuilders are busily endeavoring to locate material and assure deliveries. The growing inquiry for freight car material will strengthen the demand for universal rolled plates, the call for which has been comparatively easy. A prominent mill has its output sold or promised for the next six months and counsels caution on the part of its representatives. Tank plates are unchanged at 4.159c., Philadelphia, and ship plates at 4.409c. to 4.659c. For marine steel and boiler steel 10c. is quoted. An isolated quotation of 3.659c. to 4.409c., Philadelphia, is still made by one mill, which is, however, pretty well sold up.

Bars.—While the nominal quotation on steel bars is 2.859c., Philadelphia, important makers in the East quote 3.009c. At the lower price only regular and preferred customers are being cared for. Iron bars are unchanged at 2.659c., Philadelphia.

Structural Material.—The only new fabricating job in this territory is one calling for 500 tons for a building for the Crown Cork & Seal Company, Baltimore. The Lenoir City Car Works (Southern Railway) is in the market for several thousand tons of shapes, plates and bars, including 2000 to 3000 tons of shapes. Pressure is being brought on Eastern mills to induce them to go beyond the second quarter, but at least one is not desirous of entering the first, although it has done so in some cases. The quotation is strong at 2.85c., Pittsburgh, or 3.009c., Philadelphia.

Billets.—A manufacturer making war munitions in this State is asking for quotations on 4900 tons of 8 x 8-in. billets, conforming to British specifications for shell steel, delivery to be at the rate of 700 tons per month, beginning at once. Makers of billets have few to sell, to the end of the first quarter, aside from those they have reserved for regular customers. Open-hearth rerolling billets are quoted at $50 to $55, and high carbon billets at $65 to $75.

Sheets.—The market is more active and stronger. Large quantities of sheets are being sought for export, and the exporters in some cases have to content themselves with smaller tonnages than they inquire for. No. 10 blue annealed sheets are quoted at 3.409c. to 3.659c., Philadelphia.

Coke.—The situation is a mixed one as to prices, but all interests are quoting higher than a week ago for both furnace and foundry for prompt delivery. The coke operators are not interested in contracting, with spot prices where they are. Spot furnace ranges from $7 to $7.50 per net ton at oven, with some interests asking up to $7.75. Contract furnace is nominal at $3.75 to $4. Spot foundry mostly ranges from $7.50 to $8 per net ton at oven, although in some quarters $8.50 is quoted. A contract for the first half is reported, in which $6 was paid for foundry coke, and the sellers thereafter wanted $6.25 per net ton at oven. The seriousness of the situation is being emphasized by all concerned. Freight rates from the principal producing districts are as follows: Connellsville, $2.05; Latrobe, $1.85, and Mountain, $1.65.

Old Material.—Local mills have not shown much interest in heavy melting steel, but rolling-mill grades are active and strong. The better conditions are largely due to the fact that Pittsburgh and other Western points are taking material from the East, in consequence of which nearby mills will have to pay more for material when they want it. Quotations for delivery in buyers' yards in this district, covering eastern

Pennsylvania and taking freight rates from 35c. to $1.35 per gross ton, are as follows:

No. 1 heavy melting steel	$16.50 to $17.00
Old steel rails, rerolling	20.50 to 21.00
Low phos. heavy melting steel scrap	23.00 to 24.00
Old steel axles (for export)	35.00 to 36.00
Old iron axles (for export)	35.00 to 36.00
Old iron rails	21.00 to 22.00
Old carwheels	16.50 to 17.00
No. 1 railroad wrought	23.00 to 23.50
Wrought-iron pipe	16.25 to 16.75
No. 1 forge fire	12.50 to 13.00
Bundled sheets	12.50 to 13.00
No. 2 busheling	10.50 to 11.00
Machine-shop turnings	9.50 to 10.00
Cast borings	10.50 to 11.00
No. 1 cast	16.75 to 17.25
Grate bars, railroad	13.00 to 13.50
Stove plate	14.00 to 14.50
Railroad malleable	13.50 to 14.00

A. M. Wood & Co., Inc., dealers in iron and steel and residues specialties, have been compelled to take larger quarters on account of rapidly increasing business, and are now occupying suite 305-7 Commercial Trust Building, Philadelphia.

Cincinnati

CINCINNATI, OHIO, Oct. 31, 1916.—(*By Wire.*)

Pig Iron.—Southern prices have again been advanced and $17, Birmingham basis, for either this year or the first half of next, is now the minimum, but few furnaces are willing to take business at this figure. The resale iron in the South appears now to be mostly in the hands of consumers who are not willing to parcel it out, although a few of them have overbought. Some Southern iron has been sold as high as $18, but this was special analysis iron and does not represent the market unless it involves a case where prompt shipment is desired. Nearby business is somewhat limited, but the order books of different sales agencies show that last week was one of the busiest periods experienced for some time. Sales of Southern iron include 2000 tons of No. 2 to a northern Ohio melter, 1000 tons of mixed grades to a southern Ohio melter and a number of orders ranging from 100 to 700 tons distributed through southern Ohio and Indiana. An Indiana melter bought 600 tons of malleable for first half shipment. Northern prices are uncertain and only a limited tonnage would be accepted from former customers at $21, Ironton, for shipment either this year or the first half of 1917. No open quotations for nearby delivery are out, as producers in that district have sold too far ahead. Virginia irons have been withdrawn from the market and no quotations are available. It was thought that Virginia production would relieve the situation here, but this does not seem to be correct. Ohio silvery irons have been advanced to $29 to $30 at furnace for an 8 per cent analysis, while 10 per cent Bessemer ferrosilicon is $34 to $35. Some business has been done at the maximum figures given. Based on freight rates of $2.90 from Birmingham and $1.26 from Ironton, we quote, f.o.b., Cincinnati, as follows:

Southern coke, No. 1 f'dry and 1 soft	$20.40 to $20.90
Southern coke, No. 2 f'dry and 2 soft	19.90 to 20.40
Southern coke, No. 3 foundry	19.40 to 19.90
Southern coke, No. 4 foundry	18.90 to 19.40
Southern gray forge	18.40 to 18.90
Ohio silvery, 8 per cent silicon	30.26 to 31.26
Southern Ohio coke, No. 1	23.76 to 24.26
Southern Ohio coke, No. 2	22.76 to 23.26
Southern Ohio coke, No. 3	22.26 to 22.76
Southern Ohio malleable Bessemer	22.76 to 23.26
Basic, Northern	22.76 to 23.26
Lake Superior charcoal	22.20 to 23.20
Standard Southern carwheel	25.40 to 25.90

(*By Mail*)

Coke.—In the Wise County, Connellsville and Pocahontas districts furnace coke for prompt shipment has been sold lately all the way from $4.50 to $7.50 per net ton at oven and 72-hr. coke at $5 to $8. The price depends almost entirely on the ability of the producers to make shipments. The same condition, as far as foundry coke is concerned, exists in the New River district. It is not possible to name any contract price that would hold 24 hours. It is probable that some business could be taken for furnace coke for shipment in the first half of next year around $4 at oven with about a 50c. advance for foundry coke, but to-day no producers are willing to take on business even at this figure. The advance in pig-iron prices has enabled oven operators who make their quotations on a sliding scale basis to make corresponding advances.

Finished Material.—The local rolling mill is quoting No. 28 galvanized sheets at 5.40c.; No. 28 black, 4.15c. and No. 10 blue annealed at 3.90c., f.o.b. Cincinnati or Newport, Ky. Local warehouses are receiving shipments on material ordered some time ago and are able to fill rush orders, but they will not accept any contracts for shipments far in advance. Local store prices on steel bars and small structural shapes are 3.35c. to 3.40c.; reinforcing concrete bars, 3.55c.; cold-rolled steel, 2-in. and larger, 3.90c.; cold-rolled shafting, 10 per cent plus the list price; No. 10 blue annealed sheets, 3.60c; wire nails, $3 per keg, base, and barb wire, $3.85 per 100 lb. It is stated that nail stocks of hardware merchants are running low and it is a matter of much concern as to getting further supplies on time.

Old Material.—Advances have been made all along the line, except on bundled sheet scrap, cast borings and steel turnings. Rerolling steel rails are quoted around $18.75 per gross ton, which is about $2 above last week's figure. The demand is very good from all sources, and the enhanced cost of pig iron is causing the substitution of scrap material possible. The following are dealers' prices, f.o.b. at yards, southern Ohio and Cincinnati:

Per Gross Ton

Bundled sheet scrap	$12.00 to $12.50
Old iron rails	19.25 to 19.75
Relaying rails, 50 lb. and up	24.25 to 24.75
Rerolling steel rails	18.75 to 19.25
Heavy melting steel scrap	16.75 to 17.25
Steel rails for melting	16.25 to 16.75

Per Net Ton

No. 1 railroad wrought	$16.75 to $17.25
Cast borings	5.00 to 5.50
Steel turnings	5.00 to 5.50
Railroad cast	13.25 to 13.75
No. 1 machinery cast	15.25 to 15.75
Burnt scrap	9.50 to 10.00
Iron axles	29.50 to 30.50
Locomotive tires (smooth inside)	23.25 to 24.00
Pipes and flues	11.25 to 11.75
Malleable and steel	13.00 to 13.50
Railroad tank and sheet	10.25 to 10.75

The offices of Crocker Brothers, pig-iron merchants, in Cincinnati, have been enlarged by the lease of an adjoining suite of rooms in the First National Bank Building. Herbert F. Topp is manager of sales at Cincinnati.

Birmingham

BIRMINGHAM, ALA., Oct. 30, 1916.

Pig Iron.—That the price of pig iron may reach $20 is the belief of even conservative iron men. Friday, Oct. 27, was a spectacular day. Up to that morning, and for a week, bookings had been made at $16. During the forenoon, order books filled rapidly through telegrams at $16.50. Before night $17 had been asked and one or two sales made at that price. On Saturday $16.50 was the minimum, with two interests asking $17 and the largest foundry-iron maker quoting $17.50, with another well-booked seller going up to the same notch. One of the Friday bookings at $16.50 was 1000 tons for Middle Western delivery. The leading interest on that day advanced to $16.50 for desirable tonnages and to $17 for small lots. A feature of the market has been the appearance of consumers whose plants are contiguous to Northern furnaces and who have never sought Birmingham iron before. A considerable quantity of very desirable iron was sold for foreign delivery at a premium of $2 to $3. The shipping agent of the British Government while here last Friday looking after deliveries on the 200,000 tons of basic it had ordered of the Sloss-Sheffield and the Woodward companies, received a telegram saying that 200,000 tons additional had been ordered, the two companies sharing equally. The Woodward Company denied receiving any such order and is reported not to be in a position to accept additional foreign basic in the light of present obligations. The local officials of the Sloss-Sheffield Company had no information in the matter. If the additional basic is placed, it will be at advanced prices, as no concessions are being made either

in export or warrant metal. Additional foreign basic orders will be taken only if quite desirable. The Republic Company will soon blow in its third stack. Car shortage is a twice-told tale, but iron men admit that it might be worse. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 foundry and soft	$17.50
No. 2 foundry and soft	17.00
No. 3 foundry	16.50
No. 4 foundry	16.25
Gray forge	16.00
Basic	17.00
Charcoal	$22.50 to 23.00

Cast-Iron Pipe.—Water and gas pipe are not so active as they have been, owing to the slackening in outdoor work with the approach of winter, but Southern points have sent in orders sufficient to keep plants going at existing productive rate for some time to come. Prices will probably advance in consonance with pig iron on new specifications. We quote, per net ton, f.o.b. yards, as follows: 4-in., $29; 6-in. and upward, $26, with $1 added for gas pipe and 16-ft. lengths.

Coal and Coke.—The car shortage has sent steam coal up to as high as $3 per ton, compared with a normal of $1.25. In a few instances oil mills and other plants have shut down for lack of coal. Coke bids fair to rise to still higher levels, owing to the bids coming for supplies from fields heretofore supplied by Virginia coke. For the present, prices remain at $4.25 to $4.50 per net ton at oven for standard beehive coke and at $3.25 to $3.50 for foundry coke.

Old Material.—The market is very active. Some steel axles have been sold at $30. Wrought scrap has advanced. Southern rolling mills and steel works are taking all the scrap available, on account of advancing prices of pig iron. We quote, per gross ton, f.o.b. dealers' yards, as follows:

Old steel axles	$25.00 to $30.00
Old steel rails	12.50 to 13.00
No. 1 wrought	15.00 to 15.50
Heavy melting steel	12.00 to 12.50
No. 1 machinery	11.50 to 12.00
Carwheels	11.50 to 12.00
Tram carwheels	11.00 to 11.50
Stove plate and light	9.50 to 10.00

St. Louis

ST. LOUIS, MO., Oct. 30, 1916.

Pig Iron.—The state of the pig-iron market in this district is such as to make quotations practically unavailable except upon the submission of specific propositions to the furnaces by the representatives. Southern furnaces will not permit the representatives to close contracts until all details are confirmed by the management. Chicago makers show just as little disposition to accept business. No Ohio iron is to be had in the market at any price prior to July 1 delivery. The sales made during the week aggregated possibly 10,000 tons, ranging from 1000 tons down. The inquiry for 10,000 tons of Northern basic reported last week remains unfilled, largely because of the unwillingness of furnaces to accept the business and make deliveries as desired.

Coke.—The coke market is in an even more erratic state than pig iron, with a total unwillingness on the part of oven representatives to accept business, even if it were possible to make deliveries. As high as $8.50 per ton, Connellsville, for best selected foundry coke, has been offered and not taken. It is also known that as high as $7.75 has been offered for 48-hr. coke and refused. Local by-product coke remains undisturbed, largely because of the fact that the output of the local ovens has been contracted ahead to July 1 at least.

Finished Iron and Steel.—The duties of finished product representatives have been largely confined the past week to the diplomatic handling of would-be buyers whose requirements they cannot meet, particularly as to delivery, as buyers are willing to pay almost any price which the mills might make. Movement out of warehouse has continued as active as ever, with buyers still willing to pay the prices asked. We quote for stock out of warehouses as follows: Soft steel bars, 3.30c.; iron bars, 3.20c. to 3.25c.; structural material, 3.30c.; tank plate, 3.80c.; No. 10 blue annealed sheets, 3.55c.; No. 28 black sheets, cold rolled, one pass, 4c.; No. 28 galvanized sheets, 5.40c.

Old Material.—The scrap market continues more than extremely strong with dealers buying everything available for delivery on their orders and mills and foundries apparently well aware that a shortage in old material is threatening. In consequence, quotations are largely nominal and transactions are subject to the needs of the buyer and the willingness of the seller to let material go. At least 15,000 tons of old material has recently been taken out of this market through quietly conducted negotiations carried on by the Colorado Fuel & Iron Company, and most of it has already been shipped. Still further advances in scrap are anticipated by the dealers, particularly in the light of the present conditions in the pig-iron market, the foreign demand and the actual shortage of supplies. Relaying rails are difficult to get, and are firmly held at the quotations made. No lists appeared during the week, except 200 tons from the Missouri & North Arkansas, but the railroads are expected to make offerings within the next few days, as is their custom at the first of the month. We quote dealers' prices f.o.b. customers' works, St. Louis industrial district, as follows:

Per Gross Ton

Old iron rails	$20.00 to $20.50
Old steel rails, rerolling	20.50 to 21.00
Old steel rails, less than 3 ft.	20.00 to 20.50
Relaying rails, standard section, subject to inspection	24.00 to 26.00
Old carwheels	14.50 to 15.00
No. 1 railroad heavy melting steel scrap	19.00 to 19.50
Heavy shoveling steel	15.50 to 16.00
Frogs, switches and guards cut apart	19.00 to 19.50
Bundled sheet scrap	9.50 to 10.00

Per Net Ton

Iron angle bars	$19.50 to $20.00
Steel angle bars	17.50 to 18.00
Iron car axles	31.50 to 32.00
Steel car axles	34.00 to 34.50
Wrought arch bars and transoms	23.50 to 24.00
No. 1 railroad wrought	18.50 to 19.00
No. 2 railroad wrought	17.50 to 18.00
Railroad springs	17.50 to 18.00
Steel couplers and knuckles	19.50 to 20.00
Locomotive tires, 42 in. and over, smooth inside	23.50 to 24.00
No. 1 dealers' forge	16.50 to 17.00
Cast-iron borings	7.00 to 7.50
No. 1 busheling	16.00 to 16.50
No. 1 boilers, cut to sheets and rings	13.00 to 13.50
No. 1 railroad cast scrap	13.50 to 14.00
Stove plate and light cast scrap	10.00 to 10.50
Railroad malleable	12.50 to 13.00
Agricultural malleable	11.00 to 11.50
Pipes and flues	13.50 to 14.00
Heavy railroad sheet and tank scrap	12.75 to 13.25
Railroad grate bars	10.50 to 11.00
Machine shop turnings	8.00 to 8.50

New York

NEW YORK, Nov. 1, 1916.

Pig Iron.—Price advances have come on so fast that it is not easy to know what is the market, though it is well known that the bulk of the business put through in the past 10 days—and there has been a good deal of it—was done at figures $2 to $3 below to-day's asking prices. The buying for the second half of 1917 took on a fast pace ten days to two weeks ago. Starting at $19 to $19.50, Buffalo, for No. 2 X on such business, there was a gradual advance to $22, Buffalo, early last week; then $23 appeared, and this week $24 and $25 is asked by two sellers in that district for what is still available for that delivery, while a third is out of the market. One eastern Pennsylvania maker has advanced from $22 to $23 at furnace for No. 2 X. It became evident some time ago that a good deal of iron bought for delivery this year would carry over into 1917, and that the sales for that period were more than had been generally known. Virginia furnaces have been heavy sellers in all markets, taking a larger share of the total than in a long time. With freights of $3.25 to $3.50, Virginia iron went freely into Buffalo in competition with local furnace iron. It went in large blocks into New England. Last week, while sales of No. 2 X were made at $19.50, Virginia furnace, for the first half of 1917, $1 a ton lower was done on second half contracts. Later, second half Virginia iron went up to a parity with first half at $19.50, and then the leading maker withdrew from the market altogether. The General Electric Company bought 14,000 to 15,000

tons, chiefly foundry iron, for its five plants, for the second half, including 3800 tons for Schenectady, 2500 tons each for Lynn and Pittsfield, and low phosphorus iron for Everett. Southern iron has sold in the week at $16 and $16.50 for No. 2 at Birmingham for first half delivery and later at $17 for the second half. A sale of 1500 tons for this year was made at $17.50, Birmingham. Some Southern sellers are not offering iron for the second half of 1917. A sale of 10,000 tons of basic unusually low in phosphorus was made to a New Jersey foundry for delivery from February to June, and 5000 to 7500 tons more will be taken, while a considerable basic inquiry has come from western New York. New England foundries, which less than two weeks ago would not consider second half iron, came into the market in a hurry three or four days later and covered freely. Naturally at to-day's prices business is less, but furnaces are so well sold that they want a good price now and look for still higher levels. Foundry coke on contract for first half has been offered at $5, while $8 to $8.50 has been the price for spot. We quote at tidewater for early delivery: No. 1 foundry, $23 to $23.50; No. 2 X, $22.50 to $23; No. 2 plain, $22 to $22.50; Southern iron at tidewater, $22.50 to $23 for No. 1 and $22 to $22.50 for No. 2 foundry and No. 2 soft.

Ferroalloys.—The ferromanganese market is devoid of orders or inquiries except for a few small lots. Some quiet buying of domestic alloy at $160 to $165, delivered, has bridged over the needs of some consumers. Specifications on contracts are urgent and receipts from England are at about the same rate as has obtained all this year. Spiegeleisen is quiet at $40 to $45, furnace, for the 20 per cent grade. Ferrosilicon, 50 per cent, is in strong demand, with specifications on contract insistent. Inquiries for 1917 are appearing in volume, but one large importer has thus far not opened his books for these orders. It is expected that next year's quotation will be not less than $100, Pittsburgh. Bessemer ferrosilicon is active. The last quotation was $34 per ton, furnace, for the 10 to 11 per cent grade, $35 for the 11 to 12 per cent grade and $36 for the 12 to 13 per cent. Ferrotungsten is obtainable at $2.60 to $2.75 per pound of contained tungsten, New York, with the ore at $17 per unit. The exports in August were 47,966 lb. Ferrovanadium is quoted at $2.75 to $3, Pittsburgh, per pound of contained vanadium. Ferrocarbon-titanium is selling at 8c. per pound, in carload lots, 10c. per pound in ton lots and 12½c. per pound in lots less than a ton. Ferrochrome, 60 to 70 per cent, is unchanged at 16c. to 20c., New York, per pound of contained chromium.

Structural Material.—While conspicuous structural projects are not individually large or numerous, an enumeration of them does not give a fair index of the present demand, as there are very many small plant and building extensions, each involving 50 to 100 tons, and these are sustaining the fabricating shops. Plain material is stiffer in that only from a very few mills can better than 2.80c., Pittsburgh, be done, and then only for the largest tonnages. Among fresh inquiries not heretofore mentioned may be noted the Broad No. 2 Telephone Exchange, 3000 tons; building for the Joseph Dixon Crucible Company, Jersey City, 1200 tons; the General Electric Company, Lynn, Mass., 800 tons; post office at Birmingham, Ala., 500 tons; Daniel Henry Building, New Haven, 600 tons; department store, Richmond, Va., 500 tons; factory at Paulsboro, N. J., 700 tons; Carpenter apartment, Eighty-second Street and Park Avenue, 500 tons; garage, Fordham Road and Grand Avenue, 400 tons, and Kenyon piershed, Fifty-seventh Street, Brooklyn, 600 tons. Recent awards embrace 1300 tons for the McAlpin Hotel addition, to the Bethlehem Steel Company; 500 tons for towers for the Duquesne Light Company, to the American Bridge Company; 360 tons of shapes and 160 tons of castings for the American Rolling Mill Company, to the American Bridge Company; 300 tons for the Consolidated Gas Company, New York, to the National Bridge Company; 300 tons for the New Departure Manufacturing Company, Bristol, Conn., to the Levering & Garrigues Company, and the following to the Hinkle Iron Company; 1200 tons for the Nameloc loft, West Thirty-sixth Street; 500 tons for a Brickner, West Seventieth Street, and 400 tons for a Brickner apartment, East Sixty-sixth Street. We quote plain material from 2.869c. to 3.169c., New York, for mill shipments, depending more on the mill selling than on the delivery, and 3.35c., New York, out of warehouse.

Steel Plates.—The cost of coal, coke, refractories, labor and other items is now being considered, in addition to a demand which, seemingly inconceivable, is greater than ever, as a primary cause for likely further price advances. As it is, one mill has fixed 4c. as minimum for universal plates and 4½c. for ship plates, while the Steel Corporation has put its minimum at 3.25c. A lot of nearly 10,000 tons for a domestic shipbuilder has just been closed at 4c. under an option of a few weeks, and one mill was obliged to refuse one lot of 10,000 tons and another of 20,000 tons. We quote universal plates at 3.419c. to 4.169c., New York, with 3.669c. minimum for earliest shipment, and sheared plates up to 84 in. and in about three months at 4.169c., New York, and the widest plates at 4.419c. to 4.669c. for what may be obtained in the first half of 1917. Plates from warehouse range from 4c. to 4.50c., New York.

Iron and Steel Bars.—The rate at which business for foreign account is being declined has lately, covering general forms of finished steel, amounted to over half the normal producing rate of the country. The minimum on steel bars for any delivery now appears to be 2.70c., Pittsburgh, with 2.85c., Pittsburgh, the best obtainable price for shipments which may be obtained in the next few months. Meanwhile bar iron is enjoying a good demand and promises to strengthen in price. We quote steel bars at 2.869c. to 3.019c., New York, the higher price for the earlier shipments. We quote mill shipments of iron bars at 2.669c., New York. From warehouse steel bars are 3.35c. to 3.50c., New York, and iron bars, 3.25c.

Old Material.—About the only consumers of scrap who are not now interested in the market are the steel companies of eastern Pennsylvania. An embargo is still in effect at Coatesville, but steel companies located at other points in that section appear to be well supplied with stock. The iron rolling mills are buying wrought scrap, wrought pipe and borings and turnings quite freely. Blast furnaces have also been taking larger quantities of mixed borings and turnings, and this has caused prices to stiffen. The demand in this market for heavy melting steel scrap is mainly coming from Sharon, Youngstown and other points in the Shenango and Mahoning valleys, causing an advance of about 75c. per ton on material suitable for such shipments. Brokers quote buying prices about as follows to local dealers and producers, per gross ton, New York:

Heavy melting steel scrap (for eastern Pennsylvania shipment)	$12.50 to $12.75
Old steel rails (short lengths) or equivalent	16.00 to 16.25
Relaying rails	28.50 to 29.00
Rerolling rails	20.50 to 21.00
Rerolling rails (for export)	22.00 to 22.50
Iron car axles (for export)	39.50 to 40.00
Steel car axles (for export)	41.00 to 41.50
No. 1 railroad wrought	20.75 to 21.00
Wrought-iron track scrap	18.00 to 18.25
No. 1 yard wrought, long	15.75 to 16.00
Light iron (nominal)	3.50 to 4.00
Cast borings (clean)	8.25 to 8.50
Machine shop turnings	7.00 to 7.25
Mixed borings and turnings	7.00 to 7.25
Wrought pipe	14.25 to 14.50

A somewhat better demand is noted for old carwheels. Foundries generally are buying scrap a little more freely, probably because of the advance in pig iron. Dealers' quotations to consumers of cast scrap are as follows, per gross ton, New York:

No. 1 cast (machinery)	$17.50 to $18.00
No. 2 cast (heavy)	15.50 to 16.00
Stove plate	12.50 to 13.00
Locomotive grate bars	12.00 to 12.50
Old carwheels	16.50 to 17.00
Malleable cast (railroad)	15.00 to 15.50

Cast-Iron Pipe.—No new public lettings of any size have made their appearance. Private buying, however, is quite brisk. A feature of the current market is that

practically all the large gas companies are negotiating for their next year's supplies of pipe. These purchases will foot up a heavy tonnage. The export trade is assuming much greater importance, and it is expected that considerably more business will be done with foreign countries now that such a sensational achievement has been effected as the securing of a contract for about 66 000 net tons for shipment to Argentina by the United States Cast Iron Pipe & Foundry Company. This contract is referred to elsewhere in some detail. Export inquiries are quite numerous. On Wednesday of last week an advance of $1 per ton was made and the upward movement of pig iron seems likely to cause another early advance in the price of pipe. Carload lots of 6 in., class B and heavier, are quoted at $32.50 per net ton, with $1 per ton extra for class A and gas pipe.

Cleveland

CLEVELAND, OHIO, Oct. 31, 1916.

Iron Ore.—The delay in the ore movement because of the car shortage at the lower Lake docks is becoming more serious, boats having been held as long as five days waiting for cars. Considerable ore is being placed on the docks that would otherwise go at once to the furnace yards. The delay has cut October shipments down materially, some estimates being that the movement for the month will be 1,000,000 tons less than it would have been without the delays caused by the lack of cars. Shippers are much behind on their schedules and most of them will find it necessary to keep their boats in operation as long as the weather permits. Considerable vessel chartering for ore for 1917 delivery has been done. No rates have yet been named for next season. However, it is believed that the rate will be 90c. or $1 per ton free from the head of the Lakes. Some chartering for last cargoes of the season was done during the week at the $1 rate. There are no new developments in next season's ore prices. We quote 1916 prices as follows, delivered lower Lake ports: Old range Bessemer, $4.45; Mesaba Bessemer, $4.20; old range non-Bessemer, $3.75; Mesaba non-Bessemer, $3.55.

Pig Iron.—Prices continue to advance on all grades. Local furnaces have marked up their quotations on foundry, malleable and basic to $23 at furnace. In the Valley, foundry and malleable iron have been quoted for several days at $23, and one interest has advanced its price to $24 and reports the sale of a small tonnage at that price. As high as $27 is being asked for Bessemer. Gray forge has sold at $22, Valley. A fair volume of inquiry is coming out, mostly for the second half. Cleveland sellers report considerable first half inquiry for foundry and malleable grades from consumers in other territories who have apparently been unable to cover for their requirements from nearby furnaces. The present high prices have resulted in sales of Virginia iron in the northern Ohio territory. This iron, at $19.50, furnace, can be brought to Cleveland at $22.70, or at a lower price than is being quoted by local furnaces. Southern iron has been advanced $1 per ton to $17, Birmingham, for No. 2 and several small lot sales have been made for first half delivery at that price. Quite a tonnage of Southern iron has also been booked for the last half delivery. There is considerable inquiry for low phosphorus iron, which is scarce for early delivery. The price has been advanced to $40, Valley furnace, and several sales for delivery over the remainder of the year have been made at this price. A small lot has been sold at $40 for first quarter. We quote, delivered Cleveland, as follows:

Bessemer	$26.95
Basic	$22.95 to 23.30
Northern No. 2 foundry	23.30
Southern No. 2 foundry	21.00
Gray forge	22.95
Jackson County silvery, 8 per cent silicon	31.62
Standard low phos., Valley furnace	40.00

Coke.—No relief is expected from the present high coke prices until the car supply becomes more adequate. Connellsville furnace coke is quoted at $7 to $7.50 per net ton at oven and standard Connellsville foundry coke at $8 to $8.25 for prompt shipment. Foundries generally have anticipated their requirements and appear to be well supplied with contract coke.

Finished Iron and Steel.—The demand in finished lines has become heavier and October specifications will show a good increase over September. Many consumers are anxious to get orders entered on the books, the price and time of delivery being a secondary consideration. One mill able to make fairly early delivery reports a heavy demand in current orders for bars, plates and structural material. Bars and shapes are quoted at 2.85c., Pittsburgh, for delivery within about two months. Local prices on plates range from 3.50c. to 4.50c., Pittsburgh. An Ohio mill that has become quite active in the semi-finished steel market has taken a contract for a round tonnage of forging billets for first half delivery from a Cleveland consumer at $55, Pittsburgh, or considerably lower than the quotations made by other mills. The demand for bar iron has become heavier and prices are firm at 2.50c. to 2.65c., Pittsburgh. The demand for hard steel bars for reinforcing purposes continues quite active and prices, which have been somewhat irregular, some business having gone as low as 2.40c., delivered, have stiffened up. The demand for sheets is heavy and prices are higher. One Ohio mill came in the market a few days ago as a buyer of galvanized sheets to replenish its Cleveland warehouse stock and the lowest quotation it secured was 4.90c. Black sheets have sold as high as 3.75c. We quote sheets at 3.50c. to 3.75c., Ohio mill, for No. 28 black; 3.25c. to 3.50c. for No. 10 and 4.90c. to 5c. for No. 28 galvanized. Warehouse business continues heavy and there is talk of advancing warehouse prices this week. Present warehouse prices are 3.40c. for steel bars and structural material; 3.75c. for plates and 3.20c. for iron bars.

Bolts, Nuts and Rivets.—An active buying movement in bolts and nuts for first quarter and first half delivery is in progress. Railroad and other large consumers are placing contracts. Prices are firm. Manufacturers will not open their books for contracts with jobbers until about Nov. 15. Some contracts for rivets for first quarter are being placed at current prices which are 4c., Pittsburgh, for structural and 4.10c. for boiler rivets. Bolt and nut discounts are as follows:

Common carriage bolts, ⅝ x 6 in., smaller or shorter, rolled thread, 50 and 5; cut thread, 40, 10 and 2½; larger or longer, 35 and 2½; machine bolts within h. p. nuts, ⅝ x 4 in., smaller and shorter, rolled thread, 50 and 10; cut thread, 50; larger and longer, 40 and 5; lag bolts, gimlet or cone point, 50 and 5; square h. p. nuts, blank or tapped, $2.70 off the list; hexagon h. p. nuts, blank or tapped, $2.70 off; c. p. c. and t. sq. nuts, blank or tapped, $2.40; hexagon nuts, all sizes, $2.80 off; cold pressed semi-finished hexagon nuts, all sizes, 60 and 5.

Old Material.—Further advances have been made on several grades. The local demand is inactive, but there has been additional buying for shipment to Youngstown and Canton. With the rapid advance in prices the past two weeks, dealers are not inclined to sell with the exception of material that must be moved, believing that prices may go higher. Consumers are unwilling to pay the price asked and, accordingly, sales are largely to dealers who are covering short orders. Cast scrap has again advanced, local sales being made as high as $15. Steel axles have become scarce, because of the heavy demand that has cleaned up all the available supply, and few axles are now being offered by railroads. Borings, turnings and bushelings are dull. We quote, f.o.b. Cleveland, as follows:

Per Gross Ton

Steel rails	$18.00 to $18.25
Iron rails	19.00 to 20.00
Steel car axles	39.00 to 40.00
Heavy melting steel scrap	18.00 to 18.50
Carwheels	14.50 to 15.00
Relaying rails, 50 lb. and over	25.00
Agricultural malleable	13.00 to 13.50
Railroad malleable	16.50 to 17.00
Steel axle turnings	12.00 to 12.50
Light bundled sheet scrap	12.00 to 12.25

Per Net Ton

Iron car axles	$34.00 to $35.00
Cast borings	6.25 to 6.50
Iron and steel turnings and drillings	5.50 to 5.75
No. 1 busheling	14.00 to 14.25
No. 1 railroad wrought	18.25 to 18.50
No. 1 cast	14.50 to 15.00
Railroad grate bars	11.00 to 11.50
Stove plate	11.00 to 11.50

Buffalo

BUFFALO, N. Y., Oct. 31, 1916.

Pig Iron.—Approximately 50,000 tons of pig iron, of all grades, has been sold in this market the past week, of which perhaps one-fourth was basic. Since these sales were reported the market has continued to advance rapidly. Some furnace interests announce they are now maintaining a $25 minimum for any grade. Furnacemen state that for the first time in years stocks are practically nil; that furnaces are sold up solidly for months ahead, and iron is now almost unobtainable. The situation has become such that iron produced anywhere can find a market irrespective of freight rates. The contract between the Rogers-Brown Iron Company and the Lackawanna Steel Company has been continued to cover the year 1917 for the hot metal output of two of the Rogers-Brown furnaces. We quote as follows, f.o.b. furnace, Buffalo, for last quarter of 1916 and for first half and last half of 1917:

High silicon irons	$26.00 to $28.00
No. 1 foundry	26.00
No. 2 X foundry	25.00
No. 2 plain	24.00 to 25.00
No. 3 foundry	24.00 to 25.00
Gray forge	24.00 to 25.00
Malleable	25.00
Basic	26.00
Bessemer	27.00 to 28.00
Charcoal, according to brand and analysis	25.00 to 27.00

Finished Iron and Steel.—The price upheaval in coal, coke and pig iron and the rapid increase in the cost of manufacturing steel products have created a peculiar situation, with a strong buying movement under way, and practically every distributer has a different set of prices to fit the occasion. A number of selling agencies report that they have been offered three times as much business, which they have been obliged to turn down without quotation, as their normal sales would total. The pressure for delivery of steel is more severe than it has been at any time during the year, showing that the actual consumer is short of his requirements. In the tin-plate market the shortage of product is perhaps more pronounced than for any other steel product, because of the determination by the mills not to permit themselves to be oversold for next season as they were this.

Old Material.—The market the past week has been in a very excited condition. Dealers found with short orders, and unable to cover, have been obliged to pay much beyond the usual market prices. Inquiries are out for practically all grades of scrap. Indications point to a shortage of steel and cast scrap, so that prices in these commodities are likely to advance steadily. We quote dealers' asking prices, per gross ton, f.o.b. Buffalo, as follows:

Heavy melting steel	$18.25 to $18.75
Low phosphorus billet and bloom ends	24.00 to 25.00
No. 1 railroad wrought scrap	20.50 to 21.00
No. 1 railroad and machinery cast scrap	17.50 to 18.00
Steel axles	34.00
Iron axles	34.00
Carwheels	15.50 to 16.00
Railroad malleable	15.50 to 16.00
Machine shop turnings	7.00 to 7.50
Heavy axle turnings	12.00
Clean cast borings	8.00 to 8.25
Iron rails	20.50 to 21.00
Locomotive grate bars	13.00 to 13.50
Stove plate (net ton)	12.00 to 12.50
Wrought pipe	13.50 to 14.00
No. 1 busheling	14.50 to 15.00
No. 2 busheling	11.50 to 12.00
Bundled sheet scrap	11.50 to 12.00
Bundled tin scrap	15.00 to 15.50

British Steel Market

American Billets Dull and Irregular—Sheet Bars Weaker

(*By Cable*)

LONDON, ENGLAND, Nov. 1, 1916.

There is a heavy forward demand for Cleveland pig iron but sales are more restricted. Hematite pig iron is quoted at 142s. 6d. and makers are selling somewhat more freely. American billets are dull and irregular with 4 in. for January-March delivery at $63. Sheet bars are weaker and quoted nominally at £15 5s. Wire rods are worth £19 for November-December delivery. All quotations are c.i.f. Liverpool. We quote as follows:

Tin plates, coke, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 33s. to 36s.

Steel black sheets, No. 28, export, f.o.b. Liverpool, £20.

Steel ship plates, Scotch, delivered local yards, £13 17s. 6d.

Steel rails, export, f.o.b. works, £10 17s. 6d.

Hematite pig iron, f.o.b. Tees, 142s. 6d., compared with about 140s. a week ago.

Sheet bars (Welsh) delivered at works in Swansea Valley, £15 5s. nominal.

Steel bars, export, f.o.b. Clyde, £18.

Ferromanganese (nominal), £33.

Ferrosilicon, 50 per cent, c.i.f., £27.

Iron and Industrial Stocks

NEW YORK, Nov. 1, 1916.

The movements of securities in the past week have not shown wide fluctuations. The general characteristic of the stock market has been sustained strength, which has been manifested by the resistance of values to sales made for the purpose of taking profits. A few securities have shown marked advances. Notable among these have been Bethlehem Steel common, which sold up to 655, and United States Cast Iron Pipe preferred, which touched 63⅞. The range of prices on active iron and industrial stocks from Wednesday of last week to Tuesday of this week has been as follows:

Allis-Chal., com.	25	- 26⅝	
Allis-Chal., pref.	81¾	- 82¾	
Am. Can, com.	61¼	- 64⅞	
Am. Can, pref.	113¼	-113⅞	
Am Car & Fdy., com.	67	- 68¾	
Am. Car & Fdy., pref.		118½	
Am. Loco., com.	79	- 83⅞	
Am. Loco., pref.	106⅞	-107	
Am. Rad., com.	405	-415	
Am. Ship, com.	59	- 63½	
Am. Ship, pref.		93	
Am. Steel Fdries.	61¼	- 63	
Bald. Loco., com.	82	- 85¾	
Bald. Loco., pref.	106	-107½	
Beth. Steel, com.	603	-655	
Beth. Steel, pref.	138	-155	
Cambria Steel	125	-139¾	
Case (J. I.), pref.	86	- 86½	
Central Fdry., com.	15	- 18¾	
Central Fdry., pref.	29	- 35	
Chic. Pneu. Tool.	72½	- 73½	
Colo. Fuel	52	- 54¾	
Cruc. Steel, com.	85	- 91	
Cruc. Steel, pref.	121	-122	
Deere & Co., pref.	96	- 96¼	
Driggs-Seabury	85	- 87	
Gen. Electric	181	-185⅞	
Gt. No. Ore Cert.	42¾	- 44½	
Int. Harv. of N. J., com.	116	-118	
Int. Harv. of N. J., pref.		120	
Int. Harv. Corp., com.		78	
La Belle Iron, com.	75	- 78¾	
Lacka. Steel	86⅝	- 90	
Lake Sup. Corp.	14	- 19⅝	
Midvale Steel	66½	- 70⅞	
Nat. En. & Stm., com.	27	- 28½	
Nat. En. & Stm., pref.		96	
N. Y. Air Brake	157⅜	-159	
Pitts. Steel, pref.	104½	-104⅝	
Pressed Stl., com.	71	- 73¾	
Pressed Stl., pref.	105	-106	
Ry. Steel Spring, com.	51¼	- 54¼	
Ry. Steel Spring, pref.	101½	-101¾	
Republic, com.	77	- 79½	
Republic, pref.	113	-114	
Sloss, com.	61	- 62⅞	
Un. Steel Alloys.	47½	- 50¼	
U. S. Pipe, com.	24½	- 26½	
U. S. Pipe, pref.	57¾	- 63⅞	
U. S. Steel, com.	117¼	-120	
U. S. Steel, pref.	121⅛	-121⅞	
Va. I. C. & Coke	48	- 57	
Warwick		9⅜	
Westing. Elec.	63¼	- 65¼	

Dividends

The American Brass Company, regular quarterly, 1½ per cent, an extra of 3½ per cent, payable Nov. 15, and a further extra of 5 per cent, payable Dec. 20. This distribution of 10 per cent, together with 15 per cent paid during three previous quarters, makes a return of 25 per cent for the year.

The Taylor-Wharton Iron & Steel Company, regular quarterly, 1¾ per cent on the preferred stock, payable Nov. 1.

The Pressed Steel Car Company, 1½ per cent on the common stock, and regular quarterly, 1¾ per cent on the preferred stock, payable Nov. 22. The common disbursement represents an increase of ½ of 1 per cent on the dividend declared July 25.

The Scovil Mfg. Company, extra, 10 per cent, payable Nov. 1, making the seventh successive month in which the company declared an extra 10 per cent dividend. The extra dividends paid so far this year amount to 93 per cent, and, with three regular quarterly payments of 2 per cent each, brings the total dividends this year up to 99 per cent.

The United States Cast Iron Pipe & Foundry Company, extra, 2 per cent on the preferred stock, payable Nov. 15. The net earnings for the nine months ended Sept. 30 amounted to $1,040,970, which is at the rate of more than 10 per cent on the preferred stock. The resolution adopted by the board of directors states that the extra dividend was declared because there remained $318,805 of previous earnings unappropriated from the net profits of the seven months ended Dec. 31, 1915, and points out that the extra 2 per cent brings the returns for the year up to 4 per cent, the dividend being payable on the same date as the last installment of ½ of 1 per cent of the 2 per cent dividend declared last January for the year 1916.

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, per 100 lb.: New York, 16.9c.; Philadelphia, 15.9c.; Boston, 18.9c. Buffalo, 11.6c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Indianapolis, 17.9c.; Chicago, 18.9c.; St. Louis, 23.6c.; Kansas City, 43.6c.; Omaha, 43.6c.; St. Paul, 32.9c.; Denver, 68.6c.; New Orleans, 30.7c.; Birmingham, Ala., 45c. Denver, pipe, 76.1c., minimum carload 46,000 lb.; structural steel and steel bars, 83.6c., minimum carload 36,000 lb. Pacific coast (by rail only), pipe, 65c.; structural steel and steel bars, 75c., minimum carload 50,000 lb.; structural steel and steel bars, 80c., minimum carload 40,000 lb. No freight rates are being published via the Panama Canal, as the boats are being used in trans-atlantic trade.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, ¼ in. thick and over, and zees 3 in. and over, 2.75c. to 2.85c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in., on one or both legs	.10
Angles, 3 in. on one or both legs less than ¼ in. thick, as per steel bar card, Sept. 1, 1909	.70
Tees, structural sizes (except elevator, handrail, car truck and conductor rail)	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909	.20 to .80
Deck beams and bulb angles	.30
Handrail tees	.75
Cutting to lengths, under 3 ft. to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive	.50
Cutting to lengths, under 1 ft.	1.55

No charge for cutting to lengths 3 ft. and over.

Plates.—Tank plates, ¼ in. thick, 6 in. up to 100 in. wide, 3.50c. to 4c. base, net cash, 30 days, or ½ of 1 per cent discount in 10 days, carload lots. Extras are:

Quality Extras

	Cents per lb.
Tank steel	Base
Pressing steel (not flange steel for boilers)	.10
Boiler and flange steel plates	.15
"A. B. M. A." and ordinary firebox steel plates	.20
Still bottom steel	.30
Locomotive firebox steel	.50

Marine steel, special extras and prices on application.

Gage Extras

Rectangular, ¼ in. thick, over 6 in. wide to 100 in. wide	Base
Lighter than ¼ in., to 3/16 in., up to 72 in. wide	.10
*Lighter than ¼ in., including 3/16 in., over 72 in. to 84	.20
*Lighter than ¼ in., including 3/16 in., over 84 in. to 96	.30
*Lighter than ¼ in., including 3/16 in., over 96 in. to 100	.40
*Lighter than ¼ in., including 3/16 in., over 100 in. to 102	.45
Lighter than 3/16 in., including No. 8, up to 72 in. wide	.15
*Lighter than 3/16 in., including No. 8, over 72 in. to 84	.25
*Lighter than 3/16 in., including No. 8, over 84 in. to 96	.35
Lighter than No. 8, including No. 10, up to 60 in. wide	.30
Lighter than No. 8, including No. 10, over 60 in. to 64	.35

Up to 72 in. and not less than 10.2 lb. per sq. ft. will be considered ¼ in.
Over 72 in. must be ordered ¼ in. thick on edge, or not less than 11 lb. per sq. ft. to take base price.
Over 72 in. wide, ordered less than 11 lb. per sq. ft., down to weight of 3/16 in., take price of 3/16 in.
Over 72 in., ordered weight 3/16 in., take No. 8 price.
Over 72 in., ordered weight No. 8, take No. 10 price.

Width Extras

Over 100 in. to 110 in. inclusive	.05
Over 110 in. to 115 in. inclusive	.10
Over 115 in. to 120 in. inclusive	.15
Over 120 in. to 125 in. inclusive	.25
Over 125 in. to 130 in. inclusive	.50
Over 130 in.	1.00

Length Extras

Universal plates 80 ft. long up to 90 ft. long	.05
Universal plates 90 ft. long up to 100 ft. long	.10
Universal plates 100 ft. long up to 110 ft. long	.20

Cutting Extras

No charge for rectangular plates to lengths 3 ft. and over.

Lengths under 3 ft. to 2 ft. inclusive	.25
Lengths under 2 ft. to 1 ft. inclusive	.50
Lengths under 1 ft.	1.55
Circles 3 ft. in diameter to 100 in.	.30
Circles over 100 to 110 in. (width extra)	.35
Circles over 110 to 115 in. (width extra)	.40
Circles over 115 to 120 in. (width extra)	.45
Circles over 120 to 125 in. (width extra)	.55
Circles over 125 to 130 in. (width extra)	.80
Circles over 130 in. (width extra)	1.30
Circles under 3 ft., to 2 ft., inclusive	.55
Circles under 2 ft., to 1 ft., inclusive	.80
Circles under 1 ft.	1.85

Half circles take circle extras.

Sketches not over four straight cuts, inc. straight taper	.10
Sketches having more than four straight cuts	.20

Plates sheared to a radius take complete circle extras.

*Including extra for width.

Wire Rods.—Including chain rods, $60 to $65.

Wire Products.—Prices to jobbers effective Oct. 19: Fence wire Nos. 6 to 9, per 100 lb., terms 60 days or 2 per cent discount in 10 days, carload lots, annealed, $2.65; galvanized, $3.35. Galvanized barb wire and staples, $3.55; painted, $2.85. Wire nails, $2.70. Galvanized nails, 1 in. and longer, $2 advance over base price; shorter than 1 in., $2.50 advance over base price. Cement-coated nails, $2.60. Woven wire fencing, 58 per cent off list for carloads, 57 off for 1000-rod lots, 56 off for less than 1000-rod lots.

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card in effect from Nov. 1, 1916, all full weight:

Butt Weld

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
⅛, ¼ and ⅜	62	35½	⅛ and ¼	51	24
½	66	51½	⅜	52	25
¾ to 3	69	55½	½	56	38
			¾ to 1½	59	42

Lap Weld

2	62	49½	1¼	45	30
2½ to 6	65	52½	1½	51	37
7 to 12	62	48½	2	52	38
13 and 14	62½	..	2½ to 4	54	41
15	50	..	4½ to 6	54	41
			7 to 12	53	40

Reamed and Drifted

1 to 3, butt	67	53½	¾ to 1½, butt	54	37
2, lap	60	47½	1¼, lap	40	24
2½ to 6, lap	63	50½	1½, lap	46	31
			2, lap	47	32
			2½ to 4, lap	50	35

Butt Weld, extra strong, plain ends

⅛, ¼ and ⅜	58	40½	⅛, ¼ and ⅜	51	34
½	63	50½	½	56	43
¾ to 1½	67	54½	¾ to 1½	60	45
2 to 3	68	55½			

Lap Weld, extra strong, plain ends

2	60	48½	1¼	47	32
2½ to 4	63	51½	1½	52	38
4½ to 6	62	50½	2	54	41
7 to 8	58	44½	2½ to 4	56	44
9 to 12	53	39½	4½ to 6	55	43
			7 to 8	49	37
			9 to 12	44	32

To the large jobbing trade an additional 5 per cent is allowed over the above discounts.

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Boiler Tubes.—Discounts on less than carloads, freight to destination added, effective from Nov. 1, 1916, are as follows:

Lap Welded Sheel		*Standard Charcoal Iron*	
1½ in.	31	1½ in.	23
1¾ and 2 in.	43	1¾ and 2 in.	35
2¼ in.	40	2¼ in.	32
2½ and 2¾ in.	46	2½ and 2¾ in.	38
3 and 3¼ in.	51	3 and 3¼ in.	43
3½ to 4½ in.	52	3½ to 4½ in.	44
5 and 6 in.	45	5 and 6 in.	37
7 to 13 in.	42	7 to 13 in.	34

Locomotive and steamship special charcoal grades bring higher prices.
1¾ in., over 18 ft., and not exceeding 22 ft., 10 per cent net extra.
2 in. and larger, over 22 ft., 10 per cent net extra.

Sheets.—Makers' prices for mill shipments on sheets of U. S. standard gage, in carload and larger lots, are as follows, 30 days net, or 2 per cent discount in 10 days:

Blue Annealed Sheets

Nos. 3 to 8	3.40 to 3.50
Nos. 10 to 12	3.15 to 3.25
Nos. 13 and 14	3.00 to 3.10
Nos. 15 and 16	3.05 to 3.15

Box Annealed Sheets, Cold Rolled

Nos. 17 to 21	3.20 to 3.30
Nos. 22 and 24	3.25 to 3.35
Nos. 25 and 26	3.30 to 3.40
No. 27	3.35 to 3.45
No. 28	3.40 to 3.50
No. 29	3.45 to 3.55
No. 30	3.55 to 3.65

Galvanized Sheets of Black Sheet Gage

Nos. 10 and 11	3.90 to 4.00
Nos. 12 to 14	4.00 to 4.10
Nos. 15 and 16	4.15 to 4.25
Nos. 17 to 21	4.30 to 4.40
Nos. 22 and 24	4.45 to 4.55
Nos. 25 and 26	4.60 to 4.70
No. 27	4.75 to 4.85
No. 28	4.90 to 5.00
No. 29	5.05 to 5.15
No. 30	5.20 to 5.30

Tin Mill Black Plate

Nos. 15 and 16	3.10 to 3.20
Nos. 17 to 21	3.15 to 3.25
Nos. 22 to 24	3.20 to 3.30
Nos. 25 to 27	3.25 to 3.35
No. 28	3.30 to 3.40
No. 29	3.35 to 3.45
No. 30	3.35 to 3.45
Nos. 30½ and 31	3.40 to 3.50

Metal Markets

The Week's Prices

Cents Per Pound for Early Delivery

	Copper, Lake	Copper, New York Electrolytic	Tin, New York	Lead New York	Lead St. Louis	Spelter New York	Spelter St. Louis
Oct. 25	28.50	28.50	41.62½	7.00	6.92½	10.25	10.00
26	28.50	28.50	42.00	7.00	6.92½	10.25	10.00
27	28.50	28.50	41.95	7.00	6.92½	10.25	10.00
28	28.50	28.50	....	7.00	6.90	10.25	10.00
30	28.75	28.50	42.00	7.00	6.90	10.37½	10.12½
31	29.00	28.50	41.87½	7.00	6.90	10.62½	10.37½

NEW YORK, Nov. 1, 1916.

Copper is strong, domestic consumers having bought heavily. The week has been a busy one in tin and quotations are slightly higher. Lead has been continuously dull and quotations are unchanged. Buying by both consumers and dealers has strengthened the spelter market. Antimony is dull and prices are unchanged.

New York

Copper.—Domestic consumers bought heavily of electrolytic this week, mostly for first quarter delivery, and the available supply is rapidly dwindling. Some of the buyers wanted November and December metal, but had to be content with later deliveries. Probably 25,000,000 lb. was taken in the movement. Last week a foreign inquiry for 100,000,000 lb. was rumored, but, if genuine, it has not yet culminated in business. New England brass interests have been in the market to cover new business in brass products, the demand for which seems to be without limit. Prompt electrolytic is quoted at 28.50c. to 29c., December at 28.25c. to 28.75c., and first quarter at 27.50c. to 28c. Prices higher than these are frequently reported. A sale of prompt Lake was made this week at 29c. The London quotation for spot electrolytic is easier at £142 10s., against £144 a week ago. The October exports totaled 29,180 tons.

Copper Average.—The average price of Lake copper for the month of October, based on daily quotations in THE IRON AGE, was 28.48c., and for electrolytic 28.49½c.

Tin.—Taken as a whole, the week has been active in the tin market. On Oct. 25, probably 400 tons, mostly of future deliveries from the Straits, was dealt in, while on Oct. 27 another 400 tons changed hands, most of it metal soon to arrive or for which licenses to ship from England have been granted. The supply of spot Banca, the price of which has been near that for Straits, is pretty nearly exhausted, but more is expected to arrive this month. Total deliveries into consumption in October totaled 4556 tons, 4000 tons of which arrived at Atlantic ports, and the remainder at Pacific ports. In stocks and landing at the end of the month was 3419 tons. The arrivals of the month amounted to 2655 tons. The quantity afloat is 2025 tons, which is under normal, and tends to strengthen the situation. Spot Straits was quoted yesterday at 41.87½c., with Banca at 41.25c.

Lead.—This metal has been continuously dull in New York. At Eastern points the independent producers are meeting the price of the leading interest, and in the West they are underquoting. The big producer continues to quote 7c., New York, and 6.92½c., St. Louis. It is learned that Japan was a notable buyer last week. Nearby lead is not plentiful, and the general aspect of the market is one of strength despite the inactivity. The spot quotation at London yesterday was £30 10s., and unchanged from a week previous. The exports of October totaled 4535 tons.

Spelter.—The market is stronger, with producers not actively looking for business. They are hopeful of a higher level of prices, and the trend already is in that direction. A feature of the week has been the activity of dealers in contracting for future deliveries, indicating that their judgment coincides with that of the producers. The brass mills have been buyers, and are still in the market. Late last week the galvanizers made a number of inquiries, many of which were not closed. A slight cold snap in the West interfered with the operation of gas-fired furnaces and also gave a stimulus to prices, and set in motion conjecture as to what will happen when the winter comes. Spot prime Western was quoted yesterday at 10.62½c., New York, and 10.37½c., St. Louis; November at 10.25c., St. Louis, December at 10.12½c., and first quarter at 10c. The exports in October totaled 12,180 tons. The spot quotation at London yesterday was £52 15s., against £54 a week ago.

Antimony.—All interest has disappeared and the market is dull at 13c. to 13.50c., duty paid.

Aluminum.—No. 1 virgin aluminum, 98 to 99 per cent pure, is easier at 64c. to 65c. per lb.

Old Metals.—The market continues firm but unchanged. Dealers' selling prices are as follows:

	Cents per lb.
Copper, heavy and crucible	27.00 to 27.25
Copper, heavy and wire	25.50 to 26.00
Copper, light and bottoms	22.50 to 23.00
Brass, heavy	15.50 to 15.75
Brass, light	12.00 to 12.50
Heavy machine composition	21.00 to 21.50
No. 1 yellow rod brass turnings	15.00 to 15.50
No. 1 red brass or composition turnings	16.00 to 17.00
Lead, heavy	6.625
Lead, tea	6.125
Zinc	7.50 to 8.00

Chicago

OCT. 30.—Further inquiry from abroad for a large quantity of copper sustains the price of the metal. Tin has not been the object of very active buying, but prices have been firmly held. Spelter is quoted somewhat higher, but the lead market is reported quiet. We quote: Casting copper, 27.50c.; Lake copper, 28.50c. to 29c.; tin, carloads, 42.50c., and small lots, 44.50c.; lead, 6.95c.; spelter, 10.25c.; sheet zinc, 15c.; Cookson's antimony, 50c.; other grades, 14.50c. to 15c. On old metals we quote buying prices for less than carload lots as follows: Copper wire, crucible shapes, 24c.; copper bottoms, 21c.; copper clips, 23c.; red brass, 19¼c.; yellow brass, 15c.; lead pipe, 6c.; zinc, 7¼c.; pewter, No. 1, 25c.; tinfoil, 30c.; block tin pipe, 35c.

St. Louis

OCT. 30.—The metal market has been firmer. Quotations to-day for carload lots are: Lead, 6.90c. to 6.92½c.; spelter, 9.75c. to 10c. On less than carload lots: Lead, 7.25c.; spelter, 11.50c.; tin, 45c.; Lake copper, 29c.; electrolytic copper, 28.75c.; antimony, Asiatic, 15c. In the Joplin district zinc blende was stronger, with the average $68 per ton for the week's sales; lead ore, average, $85. On miscellaneous scrap metals, we quote dealers' buying prices as follows: Light brass, 9c.; heavy yellow brass, 12c.; heavy red brass and light copper, 17c.; heavy copper and copper wire, 19c.; zinc, 6c.; lead, 5c.; tea lead, 3.50c.; pewter, 25c.; tinfoil, 31c.

Bethlehem Enlargements at Sparrows Point

Pittsburgh advices state that the Bethlehem Steel Company has awarded a $2,000,000 contract to the Dravo Contracting Company for foundations for four blast furnaces, an open-hearth plant and blooming, slabbing and plate mills at Sparrows Point, Md., for the Maryland Steel Company.

A New York dealer in metals has sent the following announcement to consumers: "In view of the car shortage condition existing throughout this country, and the movement on the part of the various railroad companies to increase the minimum carload lot from 50,000 to 60,000 lb. for spelter, and presumably for copper and lead, we will in future make sales in 30-ton lots instead of 25 as heretofore. However, we are perfectly willing to sell you 25-ton lots with the understanding that in the event of the railroads charging any additional freight on account of our shipping less than the minimum of 60,000 lb. you will assume this extra freight charge."

OBITUARY

Arthur C. Eastwood

Arthur C. Eastwood, president Electric Controller & Mfg. Company, Cleveland, died Oct. 17, at Battle Creek, Mich. He received his early education in the public schools of Louisville, Ky., and his technical education at the Rose Polytechnic Institute. Shortly after graduation from college, in 1898, he entered the electrical department of the Homestead Steel Works, and was associated with A. C. Dinkey in the first extensive applications of electrical power in the manufacture of steel. He left Homestead to accept the position of electrical engineer in the mills of the Tennessee Coal, Iron & Railroad Company, then being built at Ensley, Ala. While at Ensley his work attracted the attention of S. T. Wellman, who persuaded him to go to Cleveland to accept the positions of electrical engineer for the Wellman-Seaver Engineering Company and chief engineer for the newly formed Electric Controller & Supply Company. As a result of Mr. Eastwood's inventive ability, the growth of the latter company was so rapid that he was soon forced to give the business his entire attention under the title of general manager and chief engineer. About 1905 Mr. Eastwood and his associates reorganized the company, and the name was changed to the Electric Controller & Mfg. Company, with Mr. Eastwood as active head of both the financial and engineering ends of the business. He was the patentee of nearly one hundred inventions, covering all phases of electrical control and power generation. His greatest pride, however, was the lifting magnet, the development of which was entirely his own work, and the perfection of which has saved the steel industry many millions of dollars. His inventive ability, however, was probably one of the less important factors in his success. His personality was of such a winning nature that he was enabled to build up an organization of devoted and loyal assistants. He was a member of the Union Club and Mayfield Country Club of Cleveland, and the Engineers' Club of New York, a fellow of the American Institute of Electrical Engineers, and a member of the New York Railroad Club and numerous other commercial and scientific organizations. He leaves his widow and three children.

James C. Wallace

James C. Wallace, president of the American Shipbuilding Company from 1905 to 1914, died at his home in Cleveland, Oct. 31, in his 52d year. Since his resignation from the company he had devoted himself to his vessel interests on the Great Lakes. His name had been linked closely with Lake vessel building for more than 20 years, as that of his father, Robert Wallace, had been for a generation. After passing through the public schools of Cleveland, the younger Wallace entered the employ of the Globe Iron Works as a machinist, learning the trade in every detail. In 1887 he went into the drafting room of the Cleveland Shipbuilding Company, of which his father was general manager and later president, and at length was given full charge of the drafting department. Five years later he was advanced to vice-president and general manager. In 1899, when the Cleveland Shipbuilding Company was absorbed by the American Shipbuilding Company, Mr. Wallace became general manager, and in 1904 was elected president. He was a director of the First National Bank, the National City Bank, Superior Savings & Trust Company, the People's Savings Bank, the Pioneer Steamship Company and other corporations.

JOSEPH LUMLEY, one of the oldest manufacturers of mining machinery in the United States, died Oct. 21 at his home in Philadelphia, following an illness of three months. He was born in Dublin, Ireland, and came to this country with his parents when he was five years old. Forty years ago he started the manufacture of engines, boilers and mining machinery, at Third and Cherry Streets, Philadelphia. He installed some of the largest mining plants in this country and in South America. He leaves his widow, a daughter and a son.

JOHN W. KISER, president Phoenix Horseshoe Company, with plants at Poughkeepsie, N. Y., and Joliet, Ill., died Oct. 31 at the Blackstone Hotel, Chicago, after a lingering illness, aged 58 years. He went to Chicago from St. Paris, Ohio, in 1889, and prior to his connection with the horseshoe business organized the Monarch Bicycle Mfg. Company, which proved exceedingly profitable. He leaves his widow and one son, John W., Jr., who is active in the management of the Phoenix Horseshoe Company at Chicago.

NAPOLEON DUBRUL, president Miller, DuBrul & Peters Company, Cincinnati, died at his residence in that city after a short illness, Oct. 26, aged 70 years. He was the inventor of a number of machines, chief among which was an automatic machine for making cigarettes. His company also manufactures hardware specialties. He leaves his widow and four sons. All the sons are connected with the company.

CAPT. THOMAS S. MARVEL died at Newburgh, N. Y., Oct. 25, aged 82 years. He was a noted builder of steamboats, having built a number of the finest vessels plying on the Hudson River. He served in the army through the Civil War.

HENRY P. SNYDER, for many years editor of the Connellsville *Courier*, making a specialty of coke news, died at his home in Connellsville, Pa., Oct. 27, from heart failure, aged 60 years.

BARTHOLOMEW F. SHAW, general superintendent of the American Brake Shoe & Foundry Company, Mahwah, N. J., died Oct. 27, at his home in Suffern, N. J., aged 44 years.

JOHN F. SCOTT, connected with the Pittsburgh Plate Glass Company and the Mansfield Coal & Coke Company, died at his home in Pittsburgh, Oct. 27.

Merrimac Foundry & Machine Auction Sale

J. E. Conant & Co., auctioneers, Lowell, Mass., state that the public sale of the properties of the Merrimac Foundry & Machine Company at Lawrence, Mass., Oct. 26, as a whole was in excess of the general expectations. The steel and glass structure, sold to be removed, was purchased by E. A. Peabody & Sons, Lawrence, at $13,100. The name, good will, patterns, etc., were purchased by A. Russell & Sons, Newburyport, for $270. The principal boiler room equipment was sold to A. Lee & Co. and E. A. Peabody & Son, Lawrence, for $723. The power unit was sold to Joseph Myerson of Boston for $550. The traveling crane equipments were sold to the McCoy-Brandt Machinery Company, Pittsburgh, for $3,550. These, with the real estate, realized $70,573.12. The equipment in detail was sold in 247 catalogued lots to purchasers more than covering New England, New York, Pennsylvania and New Jersey. The principal purchasers of this equipment were the Mansfield Foundry Company, Mansfield; Thomas H. Stewart, Graniteville; Boston Gear Works, Quincy; Improved Paper Machinery Company of Nashua; Alexander & Garsed, Charlotte, N. C.; John Quinn, Philadelphia; Sweet & Doyle Foundry & Machine Company, Green Island, N. Y.; Stockbridge Machine Company and Wright Wire Company, Worcester; E. Le Barron Foundry Company, Brockton; American & British Mfg. Company, Providence; Hopkins Machine Works, Bridgeton, R. I.; George G. McLauchlin Mfg. Company and Morey & Co., Boston; A. Russell & Sons Company, Newburyport; N. C. Bartlett, Haverhill; Scannell Boiler Works, Lowell; Lee & Smith, Lawrence Lumber Company, Samuel Smith Machinery Company, Davis Foundry Company, Hamblett Machine Company, John Shea, E. McCabe & Co., and Hart Foundry Company, all of Lawrence. The total sale, covering the real estate, machinery, mechanical equipment, and other personal property amounted to $76,600.

PERSONAL

K. W. Zimmerschied, chief metallurgist, General Motors Company, addressed the Steel Treating Research Club on Friday evening, Oct. 27, at the Detroit Engineering Society's rooms, 46 West Grand River Avenue, Detroit, on "Cause and Mechanism of Steel Failures."

P. J. Mundie, superintendent of the merchant mills of the Pittsburgh Crucible Steel Company, Midland, Pa., has resigned to accept a more lucrative position in the South.

J. J. Callahan, who was formerly connected for several years with the Union Drawn Steel Company at its New York office, has been appointed Eastern sales agent for the Moltrup Steel Products Company, Beaver Falls, Pa., and has located his office in the Tribune Building, New York City.

M. William Nolan, formerly of the United States Navy engineering department, Washington, D. C., has been appointed field engineer for the Huessener Engineering Company, 1405 Oliver Building, Pittsburgh.

Harvey M. Clymer, for a number of years assistant to H. C. Gable, sales manager for the American Iron & Steel Mfg. Company, Lebanon, Pa., has resigned to accept the post of sales manager for the Lebanon Valley Iron & Steel Mfg. Company.

Emmett L. Adams, organizer for the International Machinists' Union, who promoted the unsuccessful strike for an 8-hr. day in the Milwaukee district, has gone to St. Louis to engage in similar work. He went to Milwaukee in September, 1915, and on July 18, 1916, called the first walkout. By Sept. 30, practically every striker was back at work, and no shop had granted a single concession.

Charles W. Stoup, former assistant manager of the Norwalk, Ohio, plant of the Crucible Steel Company of America, and recently in the general offices at Midland, Pa., has become manager of the Norwalk plant, succeeding H. E. Frazier, who has returned to the Midland plant.

B. Dyer has resigned as advertising manager of the National Carbon Company, Cleveland, and has taken a similar position with the Aluminum Castings Company, also of Cleveland.

W. J. Parker recently severed his connection with the sales department of the Standard Tool Company, Cleveland, to devote his whole attention to the Cleveland Power Transmission Company, in the ownership of which he and others are associated. This company is located at 828 Garfield Building, Cleveland, and is doing a jobbing business in twist drills, reamers, milling cutters and other small tools.

William P. Anderson, general superintendent of the Dayton Engineering Laboratories, Dayton, Ohio, has resigned to accept the presidency of the new Dayton Screw Company.

Howard See, formerly with the American Rolling Mill Company, Middletown, Ohio, has been appointed vice-president and general manager of the Dixie Culvert & Metal Company, Atlanta, Ga.

W. C. McCain, superintendent of the blooming mill of the Pittsburgh Crucible Steel Company, Midland, Pa., resigned his position Nov. 1.

George A. Cragin, formerly assistant general sales agent of the American Steel & Wire Company, and for seven years in charge of its Worcester territory, has been appointed sales manager of the wire department of the National India Rubber Company, Bristol, R. I. He had been connected with the American Steel & Wire Company and its predecessors for 35 years.

Dr. W. H. Hatfield has been made head of the Brown-Firth research laboratory, Sheffield, England, succeeding Harry Brearley.

Prof. J. O. Arnold has been elected a member of the council of the British Iron and Steel Institute.

Morris Knowles, consulting engineer, Pittsburgh, has been appointed transit commissioner by the mayor. This is a newly created position for the purpose of preparing plans for a subway, which is badly needed to handle the congested traffic. It is proposed to build a subway from the lower end of the city to the East End, a distance of about five miles, with probably two or three branches diverging from the main line to handle traffic to populous centers.

L. S. Devos, formerly purchasing agent for R. Martens & Co., 24 State Street, has joined the selling force of the Selson Engineering Company, 78 Broad Street, New York.

Joseph Esherick has resigned as manager of the valve and specialty department of the Yarnall-Waring Company, Philadelphia, to become the Philadelphia representative of the D. Connelly Boiler Company, National Steam Pump Company and the Foxboro Company.

A. W. Foote, president Foote-Burt Company, Cleveland, builder of drilling machinery, has been elected president of the H. A. Lozier Company, automobile maker, Cleveland.

Ross Anderson, manager of production of the Poole Engineering Machine Company, Baltimore, Md., has been made works manager.

Robert E. Hall, vice-president Goulds Mfg. Company, is now in charge of the Chicago office and Northwestern territory, with offices at 12 South Clinton Street, Chicago.

Andrew Glass, vice-president and general manager Whitaker-Glessner Company, Portsmouth, Ohio, is reported convalescing from an attack of typhoid fever.

United Alloy Steel Corporation's Officers

Organization of the United Alloy Steel Corporation, which has taken over the United Steel Company, Canton, Ohio, has been effected by the election of following officers and directors: Chairman of board of directors, Edward A. Langenbach, president Berger Mfg. Company; president, Harry R. Jones; first vice-president in charge of sales, E. D. Rogers; secretary and treasurer, E. L. Hang. The board of directors consists of the above and William H. Woodin, president American Car & Foundry Company; E. H. Wells, president Babcock & Wilcox Company; H. Coulby of Pickands, Mather & Co.; Bayard Dominick, Dominick & Dominick; and John W. Prentiss, Hornblower & Weeks.

Mr. Langenbach was the principal stockholder in the United Steel Company, and has reinvested in United Alloy Steel stock most of the money he received for his interest in the old company. The Berger Mfg. Company is a heavy buyer of steel from the United Company, and under its contract will take up to 10,000 tons a month. The association of the American Car & Foundry Company and the Babcock & Wilcox Company with the United Company is understood to indicate that these companies will become important purchasers of alloy steel. Pickands, Mather & Co., Cleveland, are half owners with the United Alloy Steel Corporation in the United Furnace Company, and will furnish this company with its iron ore. Mr. Coulby will represent this interest in the company.

United States Ordnance Bids

The Midvale Steel & Ordnance Company was the lowest bidder on 40 16-in. guns for the navy and two 16-in. for the army. Its only other competitor was the Bethlehem Steel Corporation. For 20 of the guns for the navy, the Midvale Company made a bid of $174,000 each, the first gun to be delivered in 23 months, and the remainder in 43 months. The Bethlehem Steel Company's bid on 22 guns for the navy was $176,100 each, the first to be delivered in 21 months, and the remainder in 43 months.

On the two army guns the Bethlehem Company bid $225,000 each, with breech mechanism according to the department's design, and $215,000 each without breech mechanism. For guns of the company's design, with breech mechanism, the bid was $220,000 each; or, without breech mechanism, $205,000 each; the first gun to be delivered in 30 months, and the second in 36 months. The Midvale Company bid $209,000 for each of the guns on its own design, without breech, or $220,000 each complete, delivery to be made in 38 and 43 months.

Pittsburgh and Nearby Districts

The former plant of the Best Mfg. Company at Twenty-fifth and Railroad streets, Pittsburgh, has been sold to Hausman & Wimmer, scrap dealers, who will utilize the building for offices and the vacant ground for a scrap yard.

The next meeting of the National Association of Sheet and Tin Plate Manufacturers will be held in its rooms in the Oliver Building, Pittsburgh, on Thursday, Nov. 9.

The Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., is asking for bids on two 20-ton cranes.

E. W. Pittman, manager of the Rankin plant of the McClintic-Marshall Company, Pittsburgh, and George H. Danforth, structural engineer of the Jones & Laughlin Steel Company, Pittsburgh, gave a joint paper on "Factors Affecting Costs of Structural Steel Shop Work" on Oct. 31, before the Engineers' Society of Western Pennsylvania at Pittsburgh.

The Farrar Advertising Agency, Empire Building, Pittsburgh, will shortly apply for a charter of incorporation under the name of the Farrar Advertising Company. G. Benjamin Martin will be president; William F. Born, secretary, and Morgan W. Eckley, treasurer. Wallace H. Russell will be one of the incorporators. The death of David C. Farrar, which occurred in August, has brought about a reorganization.

The Manufacturers' Light & Heat Company, Pittsburgh, has advanced the price of natural gas to manufacturers in the East Liverpool, Ohio, district 1c. per 1000 cu. ft., effective Nov. 1.

The William B. Pollock Company, Youngstown, recently made a shipment of three steel slag cars to Sweden.

Stockholders of the Federal Radiator Company, New Castle, Pa., will shortly be asked to authorize an increase in the company's capital stock from $600,000 to $1,000,000. Of the increase, $200,000 will be common stock and $200,000 will be 7 per cent preferred. The funds provided will be used for plant extensions.

The Phoenix Iron Works Company, Meadville, Pa., is erecting a four-story brick and steel pattern shop and pattern storage building, of fireproof construction, and is also building a new power plant, which will provide an increase of about 500 hp. Three horizontal return tubular boilers, an engine and a generator are to be installed. The company recently placed an order for a 6-ton cage-operated monorail traveling hoist with the Sprague works of the General Electric Company. The runway for the hoist will extend through the greater part of the plant and over the yard. The company is also adding an open side planer, 72 x 84 in. x 16 ft. It recently completed an addition to its steel-plate shop and installed an additional overhead electric traveling crane and a 96-in. cupola, built by the Whiting Foundry & Equipment Company, Harvey, Ill. It is in the market for a 30 or 35 ton electric traveling crane with an auxiliary hoist.

The Beaver Refrigerator Mfg. Company, New Brighton, Pa., maker of Tettenborn porcelain refrigerators and porcelain ware specialties, has contracted for the erection of a one-story factory to cost about $75,000.

The American Steel Foundries will build two more 40-ton open-hearth furnaces at its plant at Sharon, Pa. It recently completed two furnaces of the same size, one of which was started a month ago and the other last week. The two furnaces now to be built will give the plant a total of seven 40-ton furnaces, making 600 tons or more per day of open-hearth steel.

The North East Foundry & Machine Company, North East, Pa., whose plant was badly damaged by fire last July, has rebuilt its works and is now making a line of gray-iron and semi-steel castings. A steel frame building, 80 x 100 ft., has been erected, in which a 54-in. cupola, built by the Whiting Foundry Equipment Company, Harvey, Ill., has been installed. The company has been incorporated. Dr. J. J. Finerty, 429 Franklin Street, Buffalo, N. Y., is president; W. G. O'Malley, vice-president; E. A. Finerty, secretary, and F. G. Pottmeyer, general manager. Mr. Pottmeyer was formerly assistant general superintendent of the plant of the Pittsburgh Iron & Steel Foundries Company, Midland, Pa.

The Engineers' Society of Western Pennsylvania, with headquarters in the Oliver Building, Pittsburgh, is planning to purchase Solitude, the home of the late George Westinghouse, at Homewood Station, on the Pennsylvania Railroad a few miles from Pittsburgh, and establish a memorial in his memory. The property comprises 10 acres, and it is proposed to make it a public park.

The blooming-mill department of the open-hearth steel plant of the Brier Hill Steel Company, Youngstown, Ohio, recently turned out 1954 tons of rolled steel in 24 hours. About Jan. 1 the company expects to have ready for operation two more 100-ton open-hearth furnaces which will increase its output of open-hearth steel from 400 to 450 tons per day.

The Arbogast Machine Company, Pittsburgh, has been incorporated with a capital of $5,000 by R. S. Geise, C. V. Arbogast and F. W. Stonecipher.

The Ball Engine Company, Erie, Pa., is seeking a second-hand power punch in good condition to punch a 1-in. hole in ¼-in. plate. The throat must be from 24 to 28 in.

Large Orders for Locomotives

Orders for 127 locomotives have been taken in the last week by the American Locomotive Company. The largest among these are 77 for the Chicago & Northwestern, 15 for the Buffalo, Rochester & Pittsburgh, 15 for the Erie, 9 for the Chicago, St. Paul, Minneapolis & Omaha, and 5 for the Hocking Valley. The Baldwin Locomotive Works will build 4 locomotives for miscellaneous companies, bringing the total orders for the week to 131. A conservative estimate puts the orders for October, including these, at 386, of which 173 are foreign. The largest month this year was 565 in February, with 473 in May and 453 in March. The total for the first half of 1916 was 2124, with 878 for the first four months, to Nov. 1, of the second half.

Site Secured for Worth Steel Plant

The Worths, formerly engaged in the manufacture of steel at Coatesville, Pa., but who sold out to the Midvale Steel & Ordnance Company, have taken over about 500 acres of land on the Delaware River between Marcus Hook, Pa., and Claymont, Del., upon which a large steel plant will be erected. It is stated that Norman R. Entrekin, associated with the Worths for a number of years, will be the general manager. The members of the Worth family interested in the project are J. Sharpless, William P., E. H. and William A. The site is situated ideally for shipments both by water and rail. The Worths have had the property under observation for several months. They have opened offices in suite 622, Commercial Trust Building, Philadelphia.

The Morgan Engineering Company, Alliance, Ohio, is building another erection shop, which is 80 x 404 ft., clear span inside. From the ground to the bottom of the truss is 38 ft.; from grade to girder rail, 29 ft. The building is of steel frame, brick walls 5 ft. high and steel sash on one side. On the other side, the new building adjoins a present building. The siding is Asbestos Protected Metal. The roof is wood purlin supported on steel trusses with 2 x 6 in. sheeting, and a slate roof on top of that. A skylight coming down 14 ft. from the ridge on each side extends the entire length of the building. The floor is asphalt block. The building will be equipped with two 25-ton cranes. It is being erected by the Austin Company, Cleveland.

The California Foundrymen's Association held a banquet at Hotel Oakland, Oakland, Cal., on the evening of Oct. 14, with over 100 present. C. M. Henderson of Berkeley presided, and A. B. C. Dohrmann of San Francisco was the principal speaker. John Hedley is president of the association.

Machinery Markets and News of the Works

RESALE TOOLS PLENTIFUL

Demand for New Equipment Unimpaired

United States Government Munitions Activity Creating Business in Machinery — Seattle's Shipments to the Orient Breaking Records

Second-hand and resale machine tools appear to be coming on the market in larger numbers, but they have not interfered with business in new equipment to any appreciable degree, in fact, the demand for standard tools is growing better in some cities, Detroit being one of these. In New York the trade is somewhat mystified by the circulation of a list of tools, the aggregate value of which is about $1,500,000, with which goes an unusual story. Those offering the tools say they were bought and paid for by a man since deceased and that his estate desires to realize on the property. The opinion is held by some that the machines probably are owned by persons who are under the ban of the British black-list.

Inquiries now before the trade in New York specify 150 24-in. lathes and a few very large ones for big rifles. Government orders for guns and ammunition are giving a considerable stimulus to the equipment used in such work. The Frankford Arsenal is planning the purchase of additional machinery, and it is not long since the Watervliet Arsenal was in the market.

The Bethlehem Steel Company has placed orders for about 35 cranes to be installed at its Sparrows Point plant.

New demand is fairly active in Cleveland, with milling and grinding machines difficult to procure.

The demand for mill and factory supplies is so great in Cincinnati that buyers cannot have all they want, the sellers deeming it best to distribute supplies so far as they can.

October is expected to prove the heaviest month in Milwaukee since the same month in 1915. All that hampers manufacturers is the continued shortage of labor.

From many directions come complaints of car shortages, but nowhere is it more acute than in the Pacific Northwest. In nine months of this year Seattle did an export business of $302,213,297, or $44,420,904 more than in all 1915. Of the nine months' total, $149,233,095 was with China, Japan and Vladivostok.

New York

NEW YORK, Nov. 1, 1916.

Members of the trade have been approached by parties who offer a large number of new machine tools, the total value of which would approximate $1,500,000, on most of which it is declared prompt delivery can be made. Lathes, shaping, planing and drilling machines are included, as well as a large number of small tools. The story told by those offering the tools is that they were bought and paid for by a man now deceased and that his estate desires to dispose of the equipment. The number of tools offered and the surrounding unusual circumstances has given rise to conjecture as to the actual facts involved, and the suggestion is made that the machines may have been purchased by some exporter, speculator or group of speculators whom the British have placed under the ban of their black-list. Beyond the statement that a shipping firm is concerned the name of the seller or sellers has not been disclosed.

The Baldwin Locomotive Works has placed on the market about 300 single-purpose lathes which have been used on small shells.

Gaston, Wigmore & Williams, 140 Broadway, New York, have made inquiry for 150 engine lathes, 24-in. and upward, for shipment to France.

The American & British Manufacturing Company, Bridgeport, Conn., is in the market for six large lathes, each valued at $6,000 to $7,000, required for turning out a United States Government order for cannon. The company has also obtained a Government contract for shells.

The Bethlehem Steel Company has awarded contracts for the large number of cranes required at its Maryland Steel Company plant, Sparrows Point, Md. The inquiry called for 35 cranes ranging in capacity from 5-ton to 175-ton. The Morgan Engineering Company and the Alliance Machine Company, both of Alliance, Ohio, were the successful bidders.

The General Electric Company, Schenectady, N. Y., and the Samuel L. Moore & Sons Corporation, Elizabeth, N. J., continue good buyers of various tools. The latter company has men working overtime on its new shops at Elizabethport.

The general trade in machine tools continues satisfactory. The list of the Standard Shipbuilding Corporation, New York, is receiving attention.

The officers of the Frankford Arsenal, Philadelphia, Pa., have under consideration the addition of equipment to enable the arsenal to increase its output of munitions.

The Taylor-Wharton Iron & Steel Company, High Bridge, N. J., has had plans prepared for large machine shop extensions. Bids are being taken on the concrete foundations and the steel superstructure.

The Moline Plow Company, in order to meet increased business, is building an addition at its Adriance-Platt branch at Poughkeepsie, N. Y., including an extension to its forge shop, 100 x 125 ft., and to its foundry, 63 x 165 ft. Plans are being prepared for another foundry addition, including a cupola, core room and brass foundry, as well as an addition to its warehouse, all of which are delayed until next spring, owing to the scarcity of building material.

The Phoenix Foundry Company, Voorheesville, N. Y., manufacturer of gray-iron castings, lost its plant by fire recently. The pattern house and office were undamaged. Ledyard Cogswell, Jr., Albany, N. Y., is manager.

The Radium Luminous Material Corporation, 55 Liberty Street, New York, will make improvements to its factory at High and Alden streets, Orange, N. J., not at Newark, as has been stated. P. M. Willis is secretary and treasurer.

Brewster & Co., Long Island City, N. Y., have increased their capital stock from $2,000,000 to $2,500,000 to provide funds for the manufacture of a chassis for its automobiles, formerly imported from England and France.

The Transmission Ball Bearing Company, manufacturer of ball bearings and elevating transfer trucks, 32 Wells Street, Buffalo, N. Y., has increased its capital stock from $100,000 to $250,000 and has let contract for a brick and steel building, 90 x 220 ft., one story, which will enable it to increase its output from 300 to 400 per cent. It is planned to have the structure, which will be erected on Military Road, Buffalo, on the New York Central Lines, ready for occupancy Jan. 1.

The H. Barcroft White Corporation, 701 South Helena Street, Syracuse, N. Y., has been incorporated with a capital stock of $5,000 by H. Barcroft White, Hans J. Bickman, and others, and is erecting a building at West Genesee and Plum streets and will act as distributor for Chevrolet automobiles for that district. H. B. White is president.

The Newburgh Ship Building Company, Newburgh, N. Y., F. N. Bain, president, has awarded contracts for a plant, 60 x 100 x 200 ft., one and two stories, to cost $30,000.

The Norwich Wire Basket Company, Norwich, N. Y., has let contract for a one-story addition, 75 x 192 ft., to its factory. M. Fermald is manager.

The Hilliard Clutch & Machine Company, Elmira, N. Y., will build an addition to its machine shop, 40 x 50 ft. Plans are in preparation.

The Harrison Mfg. Company, Lockport, N. Y., Herbert

C. Harrison, president, will build an extensive addition to its plant, which will more than double its capacity, and increase the number of men employed from 250 to 1000. The company is now a subsidiary of the United Motors Corporation.

The American Can Company, 120 Broadway, New York, has let contract to the Turner Construction Company for a factory and warehouse, 75 x 180 ft., three stories, at Fairport, N. Y., to cost $50,000.

The C. W. Prichard Company, 50 Church Street, New York, will buy one 8-ft. heavy-duty planing machine, one 10-ft. heavy-duty planing machine and one 60 to 72-in. heavy type lathe with 25 to 35 ft. bed, all of massive type.

The American P. I. Company, 48 East Eighth Street, New York, is in the market for electric motors.

The Sperry Gyroscope Company, Manhattan Bridge Plaza, Brooklyn, N. Y., is in the market for a 6-ft. heavy type plain radial drill press.

The Oscar Barnett Foundry Company, Irvington, N. J., is seeking a second-hand 10-ton standard gage locomotive crane in good condition.

The Estate of Adolph Starke, 577 Columbia Street, Brooklyn, N. Y., wants a bolt-heading machine of Acme or equivalent type and a roll spike pointer.

The Strong Machinery & Supply Company, 21 Walker Street, New York, will purchase a second-hand boiler in good condition of from 75 to 150 hp., for a working pressure of 125 lb. per sq. in.

The Atlantic Stamping Company, manufacturer of wash boilers, etc., Rochester, N. Y., has let contract for three additions to its factory, each 26 x 30 ft.

Contract has been let to the Forest City Steel & Iron Company, Cleveland, Ohio, for the construction on the Buffalo River and Buffalo Creek Terminal Railroad, Buffalo, of a stone-crushing and storage plant for the Kelly Island Lime & Transport Company. J. A. Kling, Cleveland, is president. The principal building will be 50 x 188 ft., one story. The cost of the plant, including unloading, conveying and crushing machinery, will be approximately $250,000.

The King Sewing Machine Company, Buffalo, has plans in progress for a further addition to its plant at Rano Street and the Lackawanna Railroad.

The Nedrew Mfg. Company, Caledonia, N. Y., will build a one-story boiler house, for which plans have just been completed.

The Buffalo Foundry & Machine Company, H. D. Miles, president, has plans completed for a one-story machine shop, 84 x 110 ft., to be erected at once.

The Peerless Marine Motor Company, 10 Lock Street, Buffalo, has let contract for a two-story factory, 50 x 70 ft., at 2150 Niagara Street.

The Salyer Tool Works, 57 Park Street, Newark, N. J., has commenced the erection of a machine shop, 85 x 194 ft., to specialize in automobile repair work at Washington and Pearl streets. It is estimated to cost $35,000. H. M. Salyer is president.

H. Louis Weiss, 255 Fabyan Place, Newark, N. J., will build a one-story machine shop.

The Valley Forge Cutlery Company, 28 South Sixth Street, Newark, N. J., manufacturer of pocket knives, will make alterations in its plant.

The Kotten Machine Company, West Side Avenue and Pennsylvania Railroad, Jersey City, N. J., has been incorporated with a capital of $100,000 to manufacture tools and machinery. Henry G. Kotten and Sidney H. Alexander, Englewood, N. J., and George W. Knappmann, 722 Chauncey Street, Brooklyn, N. Y., are the incorporators.

The American Type Founders Company, Jersey City, N. J., will build a two-story brick type building, and two-story brick and gas producer plant to its works on Garrabrant Street.

The Standard Tool & Mfg. Company, 237 Laurel Avenue, Arlington, N. J., has been incorporated with a capital of $25,000 by John Stranberg and Bernard Keating, Arlington, and Fred Roach, 59 Howard Street, Newark.

The Roessler & Hasslacher Chemical Company, Perth Amboy, N. J., has acquired extensive properties near Charleston, W. Va., and plans for the erection of a new plant to cost about $1,000,000.

The Union Bag & Paper Company, Bakers Falls, N. Y., has plans in preparation for a four-story paper mill. E. C. Barrett is president.

The International Paper Company will build a hydro-electric power station at Glens Falls, N. Y., and has awarded contract for its construction to the H. P. Cummings Construction Company, Ware, Mass.

The Dahlstrom Metallic Door Company, Jamestown, N. Y., has let contract for erection of two buildings, 40 x 120 ft. and 100 x 100 ft., respectively, each one story, to cost $20,000.

New England

BOSTON, Oct. 30, 1916.

The Bridgeport Projectile Company, Bridgeport, Conn., which has secured a contract for guns and ammunition from the United States Government amounting to $2,000,000, has awarded a contract for a two-story gun plant, 120 x 300 ft. This addition will make it the third largest plant of its kind, it is said, in the United States.

The Robertson-Northrop Company, Cambridge, Mass., has been incorporated with capital stock of $50,000 to manufacture telephone appliances, etc. The directors are H. B. Northrop, president; Edward F. Robertson, 15 Haviland Street, Boston, treasurer; and George H. Mellen.

The American Tool & Machine Company, 1417 Hyde Park Avenue, Hyde Park, Mass., is to build a blacksmith shop, 50 x 60 ft., two stories.

The American Ammunition Company, formerly controlled by the R. B. Phillips Mfg. Company, which occupied two stories of the Critchley factory on Grand Street Court, Worcester, Mass., is being moved to Ste. Catherines, Ont., Canada, where it is reported that the British Government is to establish one of the largest ammunition plants on this continent. The space vacated will be taken over by the Critchley Machine Screw Company, which has orders ahead for many months of work in the manufacture of screw machine products.

The Leland-Gifford Company, 1025 Southbridge Street, Worcester, Mass., has awarded a contract for the construction of an addition, 62 x 102 ft., four stories. A wing will also be added, 62 x 124 ft., of the same height. This addition will permit the company to increase its working force from the present number of about 450 to 700 or 800 hands. The company manufactures drilling machines and particularizes in the grinding of crankshafts.

The Perkins Appliance Company, Springfield, Mass., has been incorporated with capital stock of $50,000 to manufacture steel, iron and other metals. The directors are J. L. Perkins, president; Harry R. Elder, 428 Main Street, Springfield, treasurer; and R. S. Miles.

The Offset Tool Company, Bridgeport, Conn., has been organized with D. J. Trivers, president; W. J. Buckley, secretary and Cyrus Barker, treasurer.

Philadelphia

PHILADELPHIA, PA., Oct. 30, 1916.

The Ontario Machine Screw Company, Ontario and Rorer streets, Philadelphia, is completing a two-story machine shop adjoining its present location, at a cost of $10,000, and will take possession early next month. J. Hugh Mackay is secretary. The company manufactures screw machine products and light metal stampings.

The Vulcan Iron Works, Wilkes-Barre, Pa., has purchased property adjoining its foundry which it will use for the present for storage purposes. No construction work is contemplated.

The Pennsylvania Equipment Company, Coleman Building, Philadelphia, is in the market for a standard gage four-wheel saddle tank locomotive weighing 25 to 45 tons, to pass Massachusetts boiler law requirements, preferably American Locomotive Company type.

Fred Pearson & Co., plush manufacturers, Manayunk, Pa., have awarded contract to A. L. Fretz & Son, contractors, 1213 Filbert Street, Philadelphia, for the construction of a one-story brick engine and power house, 37 x 100 ft., to cost about $7,500.

L. B. Hilliard, Wilkes-Barre, Pa.; R. W. Archibald, Scranton, Pa., and W. L. Foster, West Pittston, Pa., trustees, succeeding the receivers of the Exeter Machine Works, manufacturer of steam engines, etc., Pittston, Pa., have authorized E. Foster Hellar, Wilkes-Barre, Pa., referee in bankruptcy, to receive applications to sell the plant during the week of Oct. 29.

The Trenton Spring Mattress Company, Trenton, N. J., manufacturer of bed springs, will build a one-story addition to its plant on Parker Avenue. Joseph D. Smith & Sons Company is the contractor.

The Co-operative Safeguarding Company, Trenton, N. J., recently organized, has acquired property on Lincoln Avenue, and will establish a plant for the manufacture of machinery safety appliances. J. Albert Homan, Trenton, is a stockholder in the company.

The Commercial Body Company, Trenton, N. J., manufacturer of bodies for automobiles, has acquired property at 809 South Broad Street for an addition to its plant.

John McKay, Bordentown, N. J., has leased property on

Park Street, and will establish a plant for the manufacture of incubators and brooders.

The Warren Foundry & Machine Company, Phillipsburg, N. J., is in the market for a 15-ton crane with 52-ft. span of the three-motor type for a 220-volt direct current.

The Kutztown Foundry & Machine Company, 1421 Chestnut Street, Philadelphia, is in the market for a 10-ton three-motor electric traveling crane for a 220-volt direct current for a 66-ft. 11-in. runway.

The Sterling Iron & Steel Company, Philadelphia, is in the market for the following electric traveling cranes: one 10-ton, 30 to 40-ft. span, for 220-volt direct current; two 3 to 5-ton, for 50-ft. span, operating on a 500-volt direct current, and one 5 to 10-ton, for 46 to 50-ft. span, for a twophase, sixty-cycle, 220-volt alternating current.

W. S. Shield, Philadelphia, will build a one-story brick garage, 165 x 200 ft., on Woodland Avenue, to cost about $30,000. The Standard Construction Company is the contractor.

The Keystone Screw Company, Philadelphia, will make alterations and additions in its plant on Seventeenth Street.

The Carwen Steel Tool Company, North Philadelphia, manufacturer of milling cutters and similar steel tools, is planning to increase the capacity of its plant by the installation of new equipment.

The Commercial Car Unit Company, Philadelphia, has been incorporated with a capital of $10,000 to manufacture motor trucks. N. S. Mackie, Philadelphia, is treasurer.

The American Ice Company, Philadelphia, will build an addition to its ice manufacturing plant on Washington Avenue. Ballinger & Perrot, Philadelphia, are the architects.

Baltimore

BALTIMORE, MD., Oct. 30, 1916.

Machinery in the plant of the Baltimore Copper Smelting & Rolling Company, Canton, Md., was destroyed by fire on Oct. 29.

The plant of the American Manganese Steel Company at New Castle, Del., suffered damage by fire Oct. 20, principally to the roof of its foundry, to the extent of about $20,000. It is placing contracts for rebuilding the burned portion of the plant which it expects to have completed within 30 days. It is operating in the meantime nearly to full capacity. Walker Brinton is local manager.

Hackley Morrison, Box 120, Richmond, Va., is in the market for the following equipment: One 10 x 10 or 10 x 12 skidder, Flory type preferred; one 9 x 10 loader, Lidgerwood type preferred; six standard gage steel logging cars; one 36-ton locomotive, standard gage; one 750 or 1000-hp. boiler feed heater; one circular sawmill of about 15,000 to 20,000 ft. per day capacity; one 750-gal. per minute fire pump; three 10, 12 or 14-track nailing or cleating machines; one 50-hp. motor, 250 volts d.c.; one 45-kw., one 40-kw. and one 20-kw. generator for 250 volts direct current; one 30,000-gal. tank with 50 or 60 ft. steel tower.

The Maryland Tube Corporation, Baltimore, has been incorporated with $500,000 capital stock by Herbert B. Stimpson, 400 Equitable Building, Baltimore; Charles H. Birmingham and Heyward Taylor. It has acquired a tract in South Baltimore and it is stated that it is planned to construct a tube, bar and sheet mill and a brass foundry. Mr. Birmingham will be in charge.

An additional unit will be built to the plant of the Crown Cork & Seal Company, 1601 Guilford Avenue, Baltimore, at Highlandtown, Md. It will be U-shaped, five stories.

The Penn-Mary Steel Company, Sparrows Point, Md., will build a blacksmith shop, 75 x 330 ft., to cost about $62,000.

With $10,000 capital stock the Edwin W. White Company, 107 Hanover Street, Baltimore, has been incorporated to deal in machinery, tools, implements, etc. The incorporators are Edwin W. White, 107 Hanover Street; Charles B. Bosley and Rignal W. Baldwin.

A garage to cost $15,000 will be built by the Star Motor & Machinery Company, Tazewell, Va.

With $100,000 capital stock the Motors Safety Starter Corporation, Richmond, Va., has been incorporated. Charles V. Carrington is secretary.

Plans for the construction of a one-story box factory are being made by David M. Lea, Richmond, Va.

The Fairbanks-Morse Company, dealer in machinery, 17 Hanover Street, Baltimore, Md., has leased 101 Light Street, and will occupy that building within the next few weeks.

The Alcoma Button Company, 123 Market Place, Baltimore, has been incorporated with $250,000 capital stock. The incorporators are Charles S. Hayden, 200 East Lexington Street, Albert N. Palmer and William H. Harris, the latter of New York City.

The Hughes Furniture Mfg. Company, Haubert and Beason streets, Baltimore, will build an addition, 50 x 90 ft., to cost $7,500.

Fire recently destroyed the new building of the Congoleum Company, Marcus Hook, Pa., used as a rubber-coating department. It will be rebuilt immediately. The damage was about $12,000.

Chicago

CHICAGO, ILL., Oct. 30, 1916.

Despite the fact that prompt delivery of machinery of almost any description can be had only at prices which argue for the postponement of every purchase that can possibly be delayed, there is a large activity in the buying of equipment. What is not now being bought is steadily accumulating against the time when lower prices shall again be in effect, and substantial assurance is to be had from this fact alone that a large domestic business will continue after the declaration of peace.

The Interstate Iron & Steel Company, Chicago, has bought a large shear and is about to buy other equipment necessitated by the expansion of its machine shop.

The Pressed Steel Mfg. Company, Cedar Rapids, Iowa, will consider the purchase of air compressors, shears, punches, stamping presses and a motor, and such valves, pipes and fittings as may be required in its business of manufacturing tanks and heating apparatus.

The Lincoln Steel & Forge Company, St. Louis, Mo., is in the market for steam drop hammers.

The Chatfield Machine & Foundry Company, Escanaba, Mich., is figuring upon additional equipment for its machine shop, to include a keyseater, pipe cutter and threader and possibly a planer and pneumatic tools and two 10-hp. and one 5-hp. motors.

Schweitzer & Conrad, 1770 Berteau Avenue, Chicago, have let contracts for a machine shop.

The Angert Wire & Iron Works, 6028 Grove Avenue, Chicago, will build a large factory to cost $75,000.

The Northwestern Electric Company, 613 West Adams Street, Chicago, is erecting an addition.

Schwertzer & Conrad will erect a one-story machine shop at 4431-39 East Ravenswood Avenue, Chicago, to cost $28,000. Van Holst & Fyfe, 72 West Adams Street, are the architects.

The Hughes Electric Heating Company, 211 West Schiller Street, Chicago, will build a one-story brick factory at Taylor Street and Waller Avenue, to cost $80,000.

C. Wouters, 2715 South Wabash Avenue, Chicago, will erect a one-story brick garage at 4943-49 South Wabash Avenue, at a cost of $20,000. R. G. Pierce is the architect.

The Chicago Bell Foundry Company, Chicago, has been incorporated with a capital of $2,500 by John Roeder, C. W. Taylor and F. L. Stetson.

Wilson & Co., Forty-first Street and Ashland Avenue, Chicago, have had plans prepared for a one-story brick factory, to cost $9,600.

The Steel Fabricating Company, Chicago Heights, Ill., will buy a second-hand 48, 60 or 72-in. gate shear of ½-in. capacity and a second-hand heavy-duty gang punch, 5 to 8 ft. long.

The Wabash Railroad Company has plans for a steel shop building to be erected at Decatur, Ill. A. O. Cunningham, Railway Exchange Building, St. Louis, is chief engineer.

The Pechstein Iron Works, Keokuk, Iowa, will be reorganized with a minimum capital of $25,000 for the erection of a building and the installation of new equipment.

The Fort Dodge Culvert Company, Fort Dodge, Iowa, has announced that it will build a new factory to cost $20,000 on ground adjoining its present quarters.

The American Fork & Hoe Company, Fort Madison, Iowa, has started work on the construction of a new plant, to consist of two buildings, one 60 x 150 ft., and the other 60 x 160 ft.

The American Cabinet Mfg. Company, Chicago, is establishing a branch plant at Fifth and Oak streets, New Albany, Ind., for the manufacture of cabinets. J. J. Quinn, of the company, states that the Chicago plant will ultimately be transferred to New Albany.

Milwaukee

MILWAUKEE, WIS., Oct. 30, 1916.

Milwaukee machine-tool builders believe the month of October will be the best ever known in volume of orders and production, with the possible exception of the same period of 1915, when conditions were abnormal. A steady stream of orders is coming in for one, two or three machines, generally in standard types. Shops are from 60 to 90 days behind on some orders and capacity on others is occupied until July 1. The labor shortage continues the most unsatisfactory feature of the situation. Other metal-working industries show unusual activity, but are also handicapped by the shortage of labor. The farm tractor industry continues to grow, although its development is hindered by the high costs of materials, and the difficulty to obtain them. Other farm machinery and implement lines are in the midst of a period of great activity.

The Jenkins Machine Company, Sheboygan, Wis., manufacturer of wood-working machinery, has passed into the ownership of A. G. Studeman and Mark Hoeper. W. W. and Louis Wolff retire. Mr. Studeman until recently was general superintendent of the wood-working machinery department of the Falls Motors Corporation, Sheboygan Falls., Wis. Mr. Hoeper has resigned as assistant treasurer and purchasing agent of the J. I. Case Plow Company, Racine, to take part in the new interest. The name of the company will not be changed, and the capital stock will remain at $70,000 for the present.

The Four Wheel Drive Auto Company, Clintonville, Wis., is spending approximately $20,000 in new tools and equipment for additions now being completed. It has a standing order for twenty trucks per week for an indefinite period and is now producing four a day. By Jan. 1 the output is to be six a day.

The Racine Auto Tire Company, corner of Fourteenth and Clarke streets, Racine, Wis., manufacturer of tires, tubes, etc., is preparing to build a new plant involving a total expenditure of $100,000. A site of four acres on High Street has been purchased and plans are being prepared for a group of factory buildings, warehouses, power plant, etc. Construction work will be carried on through the winter.

L. G. Widule, county clerk, Milwaukee, will close bids Nov. 10 at 9.30 a. m., for electric motors, starting boxes, etc., required for the chair factory unit of the new Milwaukee County House of Correction, North Milwaukee. The architects are Leenhouts & Guthrie, 428 Jefferson Street.

Wegner & Pirwitz, Marshfield, Wis., are building a machine shop addition, 36 x 88 ft., to their garage.

Schneider & Dorff, Milwaukee, have awarded contracts for the erection of a garage and repair shop, 55 x 146 ft., two stories and basement.

The Wrought Washer Mfg. Company, Milwaukee, will build a new warehouse, stockroom and shipping room, 90 x 331 ft., one-story, at 54-60 South Bay Street.

The Neacy-Read Investment Company, Downer Avenue and Webster Place, Milwaukee, will build a garage, 110 x 122 ft., two stories and basement, at a cost of $50,000.

A report from Schleisingerville, Wis., states that Robert LaPoint, formerly with the International Harvester Company, Milwaukee, has purchased the controlling interest in the Standard Machinery Company, Inc., maker of gasoline engines and farm implements. The name has been changed to the LaPoint Foundry Company and the force will be increased to handle additional business.

The Industrial Chemical Company, 200-210 Pleasant Street, Milwaukee, has established a chemical manufactory at South Milwaukee, Wis. P. A. Singer is general superintendent.

The John Strange Paper Company, Neenah, Wis., is planning to construct a new dam and hydroelectric plant at McDill, near Stevens Point, Wis. It has purchased the property of the Wisconsin Graphite Company and will establish a paper mill.

The Gillette Safety Tire Company, Eau Claire, Wis., expects to open its new plant Dec. 1, instead of Nov. 1, the delay being caused by the difficulty of getting equipment deliveries.

The Philadelphia & Reading Coal Company, 704 Majestic Building, Milwaukee, will construct a one-story reinforced concrete coal pocket and conveyor house, 30 x 72 ft., costing $5,000, at Sixteenth and Canal streets. E. J. McDonald is manager.

The Brandt Cashier Company, Watertown, Wis., manufacturer of cash register and accounting machines, is enlarging its capacity.

The Western Machine Company, Milwaukee, has been incorporated with $5,000 capital stock by William E. Bechmann, Eric H. Redstrom and B. Beebe.

The board of education, LaCrosse, Wis., is having plans made for remodeling the old high school building for manual training purposes at a cost of $30,000.

The LaCrosse Tractor Company, LaCrosse, Wis., has been organized in Delaware with a capital stock of $1,500,000 to manufacture tractors and other farm machinery and will take over the business of the Stay-Rite Engine Company, maker of gasoline engines. The incorporators are L. Hirshheimer, J. M. Fixon, L. F. Easton and L. C. Colman, all of LaCrosse.

The Interstate Steel Mfg. Company, Milwaukee, has been incorporated with a capital stock of $60,000 by James J. Devlin, Walter B. Potter and Harry F. Bayley, president of the Bayley Structural Iron Company, Milwaukee.

The Car Lighting Improvement Company, Milwaukee, has been organized with a capital stock of $25,000 to manufacture the Watson system for lighting. The incorporators are T. H. Spence and other members of the law firm of Quarles, Spence & Quarles, Sentinel Building.

Cleveland

CLEVELAND, OHIO, Oct. 30, 1916.

New demand for small lots of machines continues fairly active. Early delivery is wanted in most cases, but some dealers are unable to take orders for standard lines because they have no stock for early shipment. While the general delivery situation shows no improvement, buyers, by shopping around, are able to secure fairly prompt shipments. Milling and grinding machines are more difficult to get. The General Electric Company is in the market for 12 large standard machines, including boring, planing and shaping machines, for its Erie, Pa., works. The Babcock & Wilcox Company is purchasing considerable equipment for its Barberton, Ohio, plant. The demand in this section is largely from makers of automobile parts, the call for tool room equipment being particularly active. The demand for punching and shearing machinery continues very active, especially from steel mills, but deliveries are not promised in less than about six months. Considerable inquiry is noted for heavy handling equipment. A Cleveland builder has taken an order for a coal handling plant for installation on the seaboard in 1918, being unable to get the work out sooner.

The American Steel & Wire Company is in the market for a 240-ft. bridge equipped with a 9-ton bucket for use in connection with its by-product coke plant at Cleveland, and an inquiry is pending from the Bethlehem Steel Company, for a 15-ton ore bridge for its Sparrows Point, Md., plant.

The Cleveland Wrought Washer Company, Cleveland, will increase its capital stock from $70,000 to $500,000 and shortly place the contract for an extension to its plant. It will add cap and set screws and screw machine products to its present line, and is in the market for lathes, shaping and milling machines, furnaces and other equipment. J. S. Jennings and G. S. Case, of the Lamson & Sessions Company, manufacturer of bolts and nuts, have become financially interested in the washer company, but no change will be made in the management.

An inquiry is in the Cleveland market from the New York, New Haven & Hartford Railroad for two open-gap punching and shearing machines.

The Carnahan Tin Plate & Sheet Company, Canton, Ohio, will purchase at once a new or second-hand guillotine squaring shear with 42, 52 or 62-in. blade to cut not less than 3/16 or ¼ plate.

The Cleveland Galvanizing Works Company, Cleveland, has commenced the erection of a one-story addition to its plant, 50 x 350 ft., to be used as a galvanizing department. When the extension is completed the portion of the old plant now used as a galvanizing department will be devoted to general manufacturing. New equipment will be installed.

The Fanner Mfg. Company, Cleveland, is enlarging its malleable iron foundry by the erection of a 40-ft. extension.

The Ohio Blower Company, Cleveland, has awarded the contract for the first unit of its new plant, to be four stories, 60 x 200 ft., of mill construction.

The Guardian Gas Appliance Company, Cleveland, recently organized with a capital stock of $25,000, will establish a plant at 2707 East Ninety-first Street for welding automobile engines and cylinders. A. R. McRitchie is general manager.

G. A. Schanze, doing business under the name of the Climax Motor Devices, 759 Rose Building, Cleveland, will shortly organize a company and plans to build a plant to manufacture magneto and generator couplings and motor indicators. Considerable machinery equipment will be required.

It is announced that the Holl Stamping & Mfg. Company, in which H. C. Holl and other Cleveland men are interested,

will be established in Mansfield, Ohio, in the plant of the Cornell Mfg. Company. It will manufacture electric equipment.

The Massillon Foundry & Machine Company, Massillon, Ohio, will increase its capital stock from $100,000 to $300,000 for the purchase of a site and erection of a new plant. It will be 100 x 300 ft., of brick and steel, and located near the plant of the Central Steel Company.

It is reported that the Standard Stamping Company, Marysville, Ohio, will move its plant next spring to Huntington, W. Va., where larger quarters will be provided.

The Good-Ware Rubber Company, 307 Masonic Temple, Elyria, Ohio, will use the Toplift & Ely plant in that city for the manufacture of automobile tires and other products. It will be remodeled and equipment added. Among the stockholders are Jacob Murbach and W. E. Brooks.

The Dahlstrom Metallic Door Company, Jamestown, N. Y., is enlarging its plant by an extension 22 x 120 ft., and the erection of a new building 100 x 100 ft. The Austin Company, Cleveland, has the contract.

Detroit

DETROIT, MICH., Oct. 30, 1916.

A pronounced increase in the number of orders and inquiries in the machinery market was evident the past week. The demand for standard machines is greater than it has been for some weeks. The largest order was for 12 high grade machines for the Springfield Body Company. Deliveries still require from four to eight months.

The Disco Electric Starter Corporation, Detroit, will begin the erection of a new factory with more than 28,000 sq. ft. of floor space which will triple its output, according to an announcement made by President S. W. Elston. Sol. Meyer, Detroit, is treasurer.

The Detroit Closed Bushing Company, Detroit, has been incorporated with $15,000 for the manufacture of closed bushings and electrical and mechanical devices. H. E. Watson, Frank M. Hydon and William Short are the incorporators.

The Michigan Stamping Company, Detroit, has increased its capital stock from $700,000 to $1,000,000.

The Lansing Cast Stone Block Company, Lansing, Mich., has begun work on a factory building. George Tews is general manager.

The Detroit Weatherproof Body Company, Detroit, recently organized with a capital stock of $200,000, is constructing several additions to its factory on Mount Elliott Avenue. It is reported that its entire output for the remainder of the year has been sold to automobile factories, and work on the additions is being rushed to provide for next year's business.

The Detroit Motor Lock Company, Detroit, has been incorporated with $30,000 by Charles R. Kerns, George M. Conner and R. M. Muir, to manufacture automobile parts.

The Hayes Motor Truck Wheel Company, St. Johns, Mich., will double its factory output. A large boiler is to be installed and a new tire press and facer added to the equipment.

The Baker-Vawter Company, St. Joseph, Mich., has awarded the contract for three factory buildings to Max Stock, Jackson, Mich., to be erected at a cost of $55,000.

The Brunswick-Balke-Collender Company has purchased the Commonwealth Adding Machine Company's plant at Muskegon, Mich., for the manufacture of steel pool and billiard tables. The building will be enlarged. It will manufacture an electric pin setter in Muskegon if labor can be secured.

The Howell Electric Motor Company, Howell, Mich., has increased its capital stock from $30,000 to $100,000 and expects to double its capacity and number of employees.

Fire destroyed the machine shop of the Moeke planing mill at Zeeland, Mich., causing a damage estimated at $16,000.

The Standard Foundry & Mfg. Company has moved its equipment from Alma to the new plant erected at St. Louis, Mich.

The Western Tool Works, Holland, Mich., is planning an addition to its plant which will double its capacity.

The Consumers Ice Company will erect an ice manufacturing plant at Grand Rapids, Mich., to cost $20,000.

Indianapolis

INDIANAPOLIS, IND., Oct. 30, 1916.

The Greencastle Foundry, Greencastle, Ind., has been taken over by Walter O'Neil and Max Prewitt, who will remodel the plant and install new machinery.

The Judd-Knoblock Corporation, South Bend, Ind., has been organized with a capital of $30,000 to manufacture flour purifying machines in connection with the George T. Smith Company. G. W. Judd will be general manager.

The Hoosier Motor Company, Goshen, Ind., is in the market for a 48 x 48-in. planing machine of from 16 to 22 ft., with four heads and in first-class shape.

The South Bend Machine Tool Company, South Bend, Ind., wants a second-hand 16 to 20-in. stroke traveling head shaping machine.

Cincinnati

CINCINNATI, OHIO, Oct. 30, 1916.

Automobile garages in different parts of the country have lately bought quite a number of machine tools and portable electric drilling machines. The steel mills are also good customers, but the demand from that source is for the larger sizes of lathes. Makers of internal combustion engines in this territory were never busier, and they are only handicapped by the advanced costs of both labor and material and the difficulty of establishing correspondingly higher selling prices on the smaller farm units. So far the car shortage has not inconvenienced the larger local plants who use coal, but some uneasiness is felt as to the winter season.

As a rule, the mill and factory supply firms are compelled to curtail shipments on many orders so as to make an equitable distribution. Shipments from the mills are much behind the schedule and prompt deliveries on many machine shop supplies are very difficult to make.

The new foundry of the Lunkenheimer Company, Cincinnati, will soon be under cover and the necessary equipment will be installed before Jan. 1.

The Citizens Artificial Ice Company, Cincinnati, will increase the capacity of its plant on Jefferson Avenue. Most of the equipment has been purchased.

The Acme Box Company, Cincinnati, has leased a building on Western Avenue and will increase the capacity of its plant.

The Norwood Sash & Door Mfg. Company, Norwood, Ohio, is making arrangements for an addition to its plant, principally for storage purposes.

The Niles Tool Works Company, Hamilton, Ohio, is contemplating the installation of an oxy-acetylene outfit in its plant.

The Dayton Screw Company, Dayton, Ohio, is a new company headed by W. P. Anderson, formerly general superintendent of the Delco Company. The company will fit up a plant in the Webb Building for the manufacture of cap screws.

The Duriron Company, Dayton, Ohio, has acquired an additional site on which an addition to its foundry will be built next year.

The W. C. Downey Company, Springfield, Ohio, maker of baling ties, has let contract for an addition to its plant, 30 x 100 ft., one story, of steel construction, to be used principally for storage purposes.

The Laboratory Supply Company, Columbus, Ohio, maker of glass and porcelain laboratory utensils, is increasing the capacity of its plant.

The Columbus Mill & Mine Supply Company, Columbus, Ohio, has made arrangements to concentrate its sales department with its structural steel plant, and will construct a building on Marion Road, 140 x 220 ft., two stories, of brick construction.

The Central Ohio Handle Company, Washington Courthouse, Ohio, has acquired the former plant of the Washington Handle Company and will add wood-working equipment.

The Marietta Mantel Company, Marietta, Ohio, is planning the erection of a new plant in the suburbs of that city.

The Central South

LOUISVILLE, KY., Oct. 30, 1916.

Much interest is being taken by industrial companies in the Interstate Commerce Commission's inquiry into the car shortage, to begin here this week, with a view to determining on a means of expediting loading and unloading of cars, which continues a seriously limiting influence on business. Inquiries in power, ice machine, plate and motor lines are numerous, many involving possible large orders. Most of the business, however, comes from the North and East.

The James Clark, Jr., Company, Louisville, manufacturer of electric motors, tools, etc., contemplates erecting a foundry to make its own castings. James Clark, Jr., is president.

The Brinly-Hardy Company, Louisville, Ky., agricultural implement manufacturer, is electrifying its plant at a cost of about $3,500, and has purchased 11 alternating-current motors of 5 to 40 hp.

The Louisville Motor Car Company, Louisville, Ky., with $10,000 of capital stock, has been incorporated by A. H. Douglas, Elizabethtown, Ky.; H. C. Dunevant, Smithville, Ky., and R. L. Thomas, Louisville, and will operate a garage.

The Roy C. Whayne Supply Company, Louisville, Ky., is in the market for a 2 or 2½-yd. steam or electric revolving shovel.

Thomas L. Barret, Louisville, Ky., is asking for a locomotive crane to handle a 2-yd. grab bucket at a 60-ft. radius, new or used.

The Simplex Farm Ditcher Company, Owensboro, Ky., has been incorporated, with a capital stock of $250,000, by Joseph Wile, G. Taylor Herr, W. H. Brannon, D. C. Stimson and J. R. Kinder, and has leased the old plant of the Owensboro Ditcher & Grader Company.

The American Metallic Packing Company, Lexington, Ky., is in the market for three return tubular boilers, 72. in. x 18 ft., 150 lb. working pressure, and a 500-hp. turbine steam engine direct connected to generator, the latter in first-class condition.

John Greeley and William Roth, Covington, Ky., have purchased the Maysville Machine & Iron Works, Maysville, Ky., formerly operated by the late Dan Daly.

Knoxville, Ky., will issue $225,000 in bonds for the purchase of a new vertical pump of 15,000,000-gal. capacity, and other improvements to the municipal water system. R. C. Anderson, Cincinnati, is engineer. The improvements will be made under direction of a commission composed of J. Wright Culton, Frank H. Mead and Capt. John M. Brooks.

The Kingsport Waterworks Company, Kingsport, Tenn., has increased its capital from $100,000 to $150,000.

The John G. Duncan Company, Knoxville, Tenn., is asking prices, for quick delivery, on 40, 50 and 60 hp. locomotive or Scotch marine boilers, second hand.

The White Oak Veneer & Lumber Company, Johnson City, Tenn., has been incorporated with $50,000 capital stock by H. T. Johnson, president, Johnson City; F. A. Jackson, secretary, Shells Mill, N. C., and others, and will establish a plant at Kingsport, Tenn. It is asking prices on electric motors, two or more veneer saws, a 7 or 8-ft. band mill and other equipment, new or second hand.

Birmingham

BIRMINGHAM, ALA., Oct. 30, 1916.

Machinery dealers are principally concerned about the slow deliveries, especially of machine tools. Wood-working machinery is quite active. The general demand is good. Small gasoline engines for farms are not in supply equal to the call. Hydroelectric apparatus remains on the active list.

The Birmingham Machine & Foundry Company, Birmingham, will at once repair the damage to machinery done by fire Oct. 25. Some machinery must be replaced.

The Morris Frogless Switch Company, Birmingham, has been incorporated with a capital stock of $100,000 by U. D. Davis, Johns, Ala.; H. C. Kelly, J. C. Morris, and others, of Birmingham, to operate a frogless switch plant.

The Southern Cotton Oil Company, Andalusia, Ala., will rebuild its plant burned with a loss of $50,000.

The Acme Ice & Bottling Company, Macon, Ga., will convert its brewery into a meat-packing plant. The machinery is to cost $100,000 and the building $300,000.

The Toccoa Machine Works, Toccoa, Ga., has been incorporated with a capital stock of $3,000 by H. L. Hayworth, T. G. Hones, and others.

The Pasco Tool Company, Atlanta, has been incorporated with a capital stock of $10,000 by George G. Pasco, A. R. Brittain, and others.

The Defi Vibration Bolt Company, Chattanooga, Tenn., has been incorporated with a capital stock of $10,000 by C. E. Buek, George W. Thompson, and others.

Texas

AUSTIN, TEX., Oct 28, 1916.

The machinery and tool trade continues satisfactory in every respect. With cotton prices still mounting upward all lines of industry and business are being stimulated to an almost unprecedented degree.

The towns of Pecos and Barstow, situated 10 miles apart, have awarded the contract for the construction of a joint waterworks plant to H. LaSalle, El Paso. The proposed improvement will cost about $200,000, and will consist of wells, pumping plant and storage reservoir.

The Texas Company, Houston, which recently increased its capital stock from $37,000,000 to $44,400,000, plans to make a further increase of $10,000,000 early in November. The refining and pipe-line facilities of the company will be greatly enlarged.

The municipal warehouse which is to be erected at Houston at a cost of $350,000, will be equipped with electric conveyors and a 20-ton electric crane.

St. Louis

ST. LOUIS, MO., Oct. 30, 1916.

Activity in the machine-tool business continues at much the same level as in the past few weeks, dealers having about all the business they can take care of. Deliveries are the chief problem in the closing of transactions. The demand continues broad and comes from all classes of industry.

The Ebbeler Motor Car Company, St. Louis, has been incorporated with a capital stock of $100,000 by L. B. Ebbeler, Windsor Springs, Mo., J. J. Pitlyk and L. E. Erwin, St. Louis, to manufacture automobiles.

The Potter Electrical Signal & Mfg. Company, C. E. Potter president, will equip a plant at 811 North Ninth Street, St. Louis, to manufacture electric signal devices for use with sprinkler systems.

The Dodson Automatic Calculator Company, Milan, Mo., has been incorporated with a capital stock of $19,000 by A. F. Dodson, John Morris and L. P. Butler to manufacture automatic calculating machines.

Sedalia, Mo., will receive bids until Nov. 6 for a sewage disposal plant estimated to cost $50,000. F. T. Leaming is city engineer and E. L. Hackett city clerk.

C. K. Birdsall, architect, Commerce Building, Kansas City, Mo., is in the market for a deep well pumping equipment and an icing machine for drinking water.

The St. Louis & Southern Illinois Interurban System, with headquarters at Benton, Ill., which has had under consideration a project for 81 miles of electric line to cost with power plant equipment about $3,000,000, has completed preparations and will shortly be in the market for the equipment.

The equipment of Prairie Creek Mine No. 4, near Fort Smith, Ark., will be increased to a capacity of 1000 tons of coal per day at a cost of $200,000 by the Central Coal & Coke Company, Kansas City, Mo.

The Lambe & Demarke Light & Water Company, Arkansas City, Ark., will equip an electric light and waterworks plant and an ice plant and is receiving bids for oil engines, a 100-kw. electric unit, etc.

The Oklahoma Oxygen Company, Oklahoma City, Okla., has been incorporated with a capital of $15,000 by T. S. Chambers, Oklahoma City; H. M. Chambers, Tonkawa, Okla., and others, to equip a plant for the manufacture of oxygen.

The mill and grain elevator of the Thomas Milling Company, Thomas, Okla., which has been destroyed by fire with a loss of $300,000, will be rebuilt.

Oklahoma City, Okla., which voted $1,500,000 for a water system, will proceed with the construction at once and will receive bids for the machinery, detailed plans for which have not been completed. C. F. Semmelbeck is clerk.

Wilburton, Okla., will spend $75,000 for improvements in its water and sewer systems, including pumping machinery and disposal equipment. The McIntosh-Walton Engineering Company, Oklahoma City, Okla., is consulting engineer.

W. D. Caldwell, Oklahoma City, Okla., will build a garage and machine shop to cost $16,000.

The Gulf, Colorado & Santa Fe Railway will build a 20 stall roundhouse and make shop improvements at Guthrie, Okla., to cost about $250,000. F. Merritt, Galveston, Tex., is chief engineer.

The Ottawa County Ice Company, Commerce, Okla., will spend about $12,000 for new machinery for ice plants at Commerce and Miami.

The Consumers Refining Company, Oklahoma City, Okla., James A. Jones president, will equip a plant to cost about $250,000 and is in the market for four 150-hp. boilers, adapted for burning residues; one engine, four steam pumps, steel tanks, filter presses, sulphuric acid retort equipment, etc. A. D. Lloyd, Skirvin Hotel, Oklahoma City, is the engineer.

J. C. Ford, Summit, Miss., is in the market for equipment for the manufacture of a wire-fastening device.

C. A. Sanders will rebuild the saw and planing mill recently burned at Magnolia, Miss., with a loss of $17,000.

Charles A. Zilker, Memphis, Tenn., has bought the ice plant at Monroe, La., and will install additional machinery, making the daily capacity 125 tons.

The Sugar By-Products Company, New Iberia, La., will install equipment for a paper mill, including pumps, baling presses, etc., also machinery to manufacture cellulose, pulp

alcohol, etc., from sugar-mill waste. Mark W. Marsden, Widener Building, Philadelphia, is president and D. W. Greene is local manager. The capital is $5,000,000.

The Northern Motor Company, St. Louis, has been incorporated with a capital stock of $16,500 by Charles Moench and others to manufacture motor car parts.

The Fire Electric Fire & Burglar Alarm Company, Wheeling, Mo., has been incorporated with a capital stock of $50,000 by A. E. Lowe, Thomas J. Lilly and W. S. Cherry.

The Pacific Coast

SEATTLE, Oct. 24, 1916.

The car shortage, particularly in Oregon, is steadily growing more acute, and the total shortage at this time is greater than ever. With water front conditions in Seattle steadily improving, and recovering from the extended longshoremen's strike, the lull in shipping from that port has been practically overcome. Seattle's water-borne commerce for the first nine months of 1916 amounted to the enormous total of $302,213,297, or $44,420,904 more than the entire twelve-month period of 1915. In this connection, it is interesting to note that of this sum, almost half, or $149,233,095, covered Seattle's trade with China, Japan and Vladivostok. This latter figure shows a gain of more than $57,000,000 over that for the entire year 1915.

While current lumber shipments are curtailed, the evidence of increasing demand, both domestic and foreign, is causing greater interest in that industry, and a number of plans for larger plants are taking shape. Machinery orders from the interior mining districts make quite a substantial aggregate, and inquiries from Alaska are fairly numerous. The movement of machine tools is satisfactory, many orders being received from new projects or additions to shops in the smaller towns, which are quite generally increasing the scope of their work. Many improvements are still being made in the shipbuilding shops, though most of the heavy machinery needed has already been ordered. There is some talk of large Diesel-engine building projects in the vicinity of Portland, but nothing is assured beyond what has already been announced by the gas engine manufacturers. Activity is general in miscellaneous manufacturing equipment.

J. F. Duthie & Co. have taken out building permits for four additional buildings for their new shipbuilding plant at Seattle. The company is preparing to build two steel steamers for A. O. Anderson & Co., Ltd., Copenhagen, Denmark.

The Albina Engine & Machine Works, Portland, has applied for permission to use certain street-ends on the waterfront adjoining its plant, where new shipbuilding facilities are to be installed.

Plans are under way for the construction for the United States Government of a wharf at Anchorage, Alaska, estimated to cost $500,000.

The Studebaker Motor Company is preparing to build a garage and shop at Belmont Avenue and Pike Street, Seattle.

The Columbia Iron & Welding Company, Astoria, Ore., has been incorporated with a capital stock of $27,000 by John Weinberg, William Silva and A. Steinberg to manufacture boilers.

The equipment of the old Boca & Loyalton Railroad roundhouse at Loyalton, Cal., is being moved to the Jeffery shops of the Western Pacific Railroad near Sacramento.

The North Coast Power Company, Portland, Ore., plans improvements to its water system to cost $50,000.

It is officially announced that the Great Northern Railway Company plans to begin work early in 1917 on the development of the Lake Chelan hydroelectric power project, to produce 150,000 hp. for use in operating its lines from Spokane to Seattle. Plans include the construction of a dam and power station at the foot of Lake Chelan. It is estimated the project will cost $16,000,000 and will provide for the electrification of 500 miles of railroad.

William Cornfoot, owner of the Albina Engine & Machine Works, Portland, Ore., announces that he will begin work on the construction of a steel shipbuilding plant in Portland.

The Kane Mfg. Company, Centralia, Wash., recently organized for $50,000 to manufacture automobile shock absorbers, has moved into a new concrete factory at Third and B streets. It plans to manufacture other accessories.

Work is progressing on the new plant of the American Can Company now under construction in Seattle. Warehouses and docks are practically completed, and work on the main factory buildings will begin immediately. The initial unit of the plant will cost $200,000; but plans provide for an ultimate expenditure of $500,000. The plant, it is stated, is to be in operation in the early spring.

The Gardner-Wilkinson Company, recently incorporated, Bend, Ore., plans the construction of a sawmill to cut 21,000,000 ft. of timber. W. R. Wilkinson is vice-president and general manager.

The Grays Harbor Shipyards, Aberdeen, Wash., has received contracts recently for six lumber schooners of the latest type equipped with Diesel engines. The vessels will have a capacity of 2,000,000 ft.

It is announced that sufficient acreage has been signed for sugar beets in the vicinity of North Yakima, Wash., to insure the immediate construction of the proposed sugar plant to be built by the Utah-Idaho Sugar Company at a cost of $1,500,000. Thomas R. Cutler is president.

Russell Brothers, manufacturers of tractors and harvesting machines, of Ohio, are completing negotiations for a site in Portland, Ore., on which a concrete and steel manufacturing plant will be built. The site, it is said, represents a cost of $50,000.

The Electric Steam Generator Company, Spokane, Wash., has filed articles of incorporation with a capital stock of $100,000. L. B. Williams, I. A. Shorno, Frank Tunis, I. M. Timberman, Charles A. Gram and H. B. Pierce are the incorporators. It will manufacture a newly patented electric steam generator.

The Eugene Iron Works, Eugene, Ore., has completed plans to rebuild the machinery room of its plant. Some new equipment will be required.

The Grays Harbor Lumber Company, Hoquiam, Wash., according to C. G. Blagen, manager, is preparing plans for improvements to its plant to cost $75,000. The capacity will be increased to 1,250,000 ft. for a 21-hr. run.

The Seaborn Shipyards, Tacoma, Wash., has contracts on hand for the construction of wooden vessels costing $1,050,000. It has recently received contract for three wooden steamers and has two ships under construction.

The Oregon Box & Mfg. Company, Bay City, Ore., has recently bought 30,000,000 ft. of spruce timber on Tillamook Bay. Logging will be started immediately, and it is understood the company will enlarge its plant.

The Columbia Iron & Welding Company, Astoria, Ore., has been incorporated with a capital stock of $27,000 by John Weinberg, William Silvo, Andrew Maki and August Steinberg to manufacture engines and boilers.

The Western Foundry & Machine Company, Ogden, Utah, has plans for a $100,000 foundry building, to be erected on the site of its present plant.

Canada

TORONTO, Oct. 30, 1916.

The ratepayers of Port Arthur, Ont., have ratified an agreement between the city and Annwell G. McIntyre, Traders Bank Building, Toronto, by which the latter, representing interests which now have four pulp mills in Canada, will erect another plant at Port Arthur. It is to have a daily capacity of 150 tons and will be constructed in three units, with a capacity of 50 tons per day each, to which is to be added a paper mill. The municipality gives 100 acres of land, with no exemption or bonus.

The building on Section 2, Welland Ship Canal, at St. Catharines, Ont., owned by Baldry, Yerburg & Hutchison, contractors, and used as an engine house, machine and blacksmith shop, was totally destroyed by fire Oct. 24, with all the contents except the locomotives. The machine shop was one of the best equipped on the canal and the loss will amount to approximately $40,000.

The Perfection Tire Company will commence work soon on the erection of a plant at Niagara Falls, Ont., for the manufacture of rubber goods, etc.

The Imperial Oil Company, Sarnia, Ont., has secured a tract of land at the south of the city and will construct another refinery there. It will cost several hundred thousand dollars and will be enlarged later.

The Benedict Company, Syracuse, N. Y., manufacturer of silverware, etc., has secured a building at Trenton, Ont., and will equip it to manufacture for its Canadian trade.

Fairbanks, Morse & Co., Ltd., has been granted a permit to erect an addition to its foundry at 1379 Bloor Street West, Toronto, at a cost of $10,000.

Tenders are being received for a building for Brown's Copper & Brass Rolling Mills, Ltd., New Toronto, Ont., to cost $50,000. J. F. Brown is president.

The Dupont Fabrikoid Company, Dufferin Street, Toronto, has commenced the erection of a plant at New Toronto, Ont., under the supervision of F. W. Curtis, Goodyear Building, Toronto, at an estimated cost of $75,000 and an estimated cost for machinery of $175,000.

Plans are being prepared by T. H. Wiley, 12 St. Paul Street, St. Catharines, Ont., for a brick mill-type foundry building for the St. Catharines Brass Works.

The Canadian Tube & Iron Company, Ltd., Montreal, will purchase a 4000-lb. double-legged steam hammer in first-class shape for quick delivery.

The lumber and planing mill of Haley & Son at St. Stephen, N. B., was almost totally destroyed by fire Oct. 17, with a loss of $100,000. Much new machinery will be required for the mill, which will be erected to replace it.

Plans are being prepared for the construction of an addition to the pumping station at Cornwall, Ont., and tenders will shortly be called. Equipment will include two centrifugal pumps and a waterwheel to cost $20,000. F. Stidwell is engineer.

The Toms Contracting Company, Toronto, has been awarded contracts for additions to the plant of the Chevrolet Motor Company, Oshawa, Ont.

The Saskatchewan Clay Products Company, Moose Jaw, Sask., will make extensive additions to its plant, including the installation of a new gas producer system for burning brick. Gordon H. Love is manager.

The Dictating Machine Company, Ltd., Toronto, has been incorporated with a capital stock of $40,000 by William E. Moore, Harry Y. Claxton, 258 George Street, and others, to manufacture receiving and transcribing machines, etc.

The K. & S. Canadian Tires, Ltd., Toronto, has been incorporated with a capital stock of $250,000 by Clarence W. Moorhead, 43 Metcalfe Avenue; George O. Merson, 241 Wright Avenue, and others, to manufacture tires, etc.

Government Purchases

WASHINGTON, D. C., Oct. 30, 1916.

Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until date not set, schedule 319, for four water-tube boilers, f.o.b. works; schedule 321, for one boring, drilling and milling machine for Washington; schedule 323, for three squeezer type molding machines.

The commanding officer of the Frankford Arsenal, Philadelphia, will receive sealed proposals until Nov. 3 under proposal 162 for furnishing one power punching press.

Sealed proposals will be received until Nov. 2 under circular 474 by the commanding officer of the Rock Island Arsenal, Rock Island, Ill., for furnishing and installing coal-handling equipment.

Bids were received by the Bureau of Supplies and Accounts, Navy Department, Washington, Oct. 24, for supplies for the naval service as follows:

Schedule 214, Ordnance

Class 176, Washington—Two cartridge case head turning lathes—Bid 200, $3,500, $3,550 and $3,600.

Class 179, Washington—Two cartridge case annealing furnaces—Bid 12, $5,500; 104, $10,600 and $12,400; 121, informal; 144, $5,690; 173, $6,500.

Schedule 225, Ordnance

Class 231, Washington—One 135-ton overhead traveling crane—Bid 126, $47,000.

Class 232, Washington—Two surface grinding machines—Bid 19, $574; 91, $858.50; 127, $499.

Class 233, Washington—Three 3-spindle drill presses—Bid 91, $220.50; 97, $187; 133, $215.25; 134, $210.

Class 234, Washington—One 36-in. x 3-ft. flat turret lathe—Bid 88, $2,207; 91, $2,801.

Class 235, Washington—Two bench milling machines—Bid 127, $492; 133, $495.

Class 236, Washington—Two universal milling machines—Bid 19, $3,025.

Class 237, Washington—One wire-feed screw machine—Bid 19, $1,152.50.

Class 238, Washington—One wire-feed screw machine—Bid 19, $2,263.50; 91, $732.60.

The names of the bidders and the numbers under which they are designated in the above list are as follows:

Bid 12, American Shop Equipment Company; 19, Brown & Sharpe Mfg. Company; 88, Jones & Lamson Machine Company; 91, Kemp Machinery Company; 97, Leland-Gifford Company; 104, The Macleod Company; 121, Metals Production Equipment Company; 126, Niles-Bement-Pond Company; 127, D. Nast Machinery Company; 133, Pratt & Whitney Company; 134, William Pilton Machinery Company; 144, W. S. Rockwell Company; 173, Tate, Jones & Co.; 200, Bullard Machine Tool Company.

NEW TRADE PUBLICATIONS

Portable Factory Cranes and Hoists.—Franklin Portable Crane & Hoist Company, Franklin, Pa. New booklet, size, 4 x 7¼ in.; pages, 20. It contains fewer pages than former booklets, and yet gives full description of the portable cranes and hoists made by this company. The company claims to be the original manufacturer of portable cranes, being owner of the patent of D. T. Lane, who was associated with the company until his death. A point made is that its prices are unchanged. The last page of the folder gives a condensed table of sizes, capacities, weights and list prices.

Mechanical Rubber Goods.—Goodyear Tire & Rubber Company, Akron, Ohio. Encyclopedia of mechanical rubber goods. Illustrates and describes the application of the company's products to paper and pulp mills and belt conveyors. The encyclopedia is a presentation of what has been found to be the best practice and the recommendations are the results of actual records in plants using Goodyear equipment. Alphabetical lists of the products and tables of weights are included, together with a number of useful hints on belting.

Forges and Furnaces.—Tate, Jones & Co., Inc., Empire Building, Pittsburgh, Pa. Two circulars. The first, No. 151, mentions a line of bolt heading forges and rod heating furnaces using either oil or gas as fuel. Illustrations and brief descriptions of both are presented, together with a list of the standard sizes of each that can be supplied. A number of views of installations are included. The second, No. 152, describes tool dressing furnaces and blacksmith forges using oil or gas as fuel. Emphasis is laid upon the simplicity and cleanliness of the apparatus, which is designed to take the place of the older coal and coke fired forges. The furnaces and forges are illustrated and tables giving the various dimensions of the standard sizes are included.

Paint Spraying Gun.—Spray Engineering Company, 92 Federal Street, Boston, Mass. Bulletin No. 310. Presents a description with illustrations of a paint gun which is a hand tool for applying all kinds of liquid coatings. The advantages claimed for this equipment, which can be used either in the shop or field, are a saving in time, the securing of better results, the covering of relatively inaccessible surfaces and ease of operation. A list of the articles which can be painted by this method is presented and mention is made of the auxiliary equipment that can be supplied for use with the apparatus. Several views of the gun in use are included.

Horizontal Routing Machine.—George Gorton Machine Company, Racine, Wis. Form No. 748. Illustrations and descriptive matter explain the operation of a universal horizontal machine for routing vent and powder grooves in fuse rings. Drawings showing the position of the grooves in the rings and the cutters employed are included. A partial list of users of the machine is given and mention is made of a heavy-duty cutting-off machine for war material and general machine work. An illustrated description of the routing machine appeared in THE IRON AGE, April 20, 1916.

Heat Treating Furnaces.—Bellevue Industrial Furnace Company, 703 Bellevue Avenue, Detroit, Mich. Catalog No. 3. Describes and illustrates a line of furnaces and their accessories for heat treating metals. The furnaces are adapted for either oil or gas fuel and in addition to furnaces for melting metal include others for annealing, brazing, case hardening, flue welding, forging, preheating and tempering. Brief specification tables are given in a number of cases in addition to the engraving and description of the furnace. A number of engravings of installations are presented, and accessories such as firebrick, burners, blowers, pressure pumps, gages and pyrometers are mentioned.

Evaporating, Concentrating and Drying Equipment.—J. P. Devine Company, Buffalo, N. Y. Bulletin No. 105. Deals with the apparatus required for the chemical and allied industries and gives in detail the apparatus needed for complete chemical, color and dyestuff plants. A separate page is given to each piece of apparatus and illustrations and brief descriptions are presented.

Fuel Oil Driven Compressors.—Chicago Pneumatic Tool Company, Fisher Building, Chicago, Ill. Bulletin No. 34-K, third edition. Treats of a line of compressors designed for operation with practically all low-grade distillates. Illustrations and capacity tables of the stationary and tank mounted types are presented, followed by a description of the construction which is supplemented by engravings of the various parts. A condensed specification table of vertical and horizontal air receivers for use with the compressors is presented together with a partial list of users. An illustrated description of the tank mounted compressor appeared in THE IRON AGE, March 2, 1916.

Iron and Steel Institute Honors Judge Gary

(*Continued from page* 1001)

with wet sacking. The furnace is then tilted for pouring. Before the sacking is burnt through, the slag is up along the back wall so that clean metal comes from the furnace. As mentioned before, only enough slag is drawn off to properly cover the steel in the ladle.

The 100-ton pouring ladle is held in place in the large hooks of the 165-ton crane, and when the bottom of the ladle is well covered with metal the molten spiegel mixture is also poured into the ladle. The molten spiegel comes from the spiegel cupolas along the track above the pouring platform, and the spiegel ladle is handled by the 35-ton trolley of the 165-ton pouring crane. When making rails the weight of spiegel mixture varies from 25,000 to 28,000 lb., depending on the specification to be met, and the weight of the heat is about 100 tons, the average for 8073 heats being 102.7 gross tons of ingots.

Tables 1 and 2 give typical analyses of the materials used, together with an average slag analysis. The iron ore is occasionally used in order to get the slag into good condition, and the analysis of spiegel mixture given is one used when making rails.

Table 1—Analysis of Materials and the Slag

	Burnt Lime, Per Cent	Burnt Dolomite, Per Cent	Burnt Magnesite Per Cent	Fluor Spar, Per Cent	Roll Scale, Per Cent	Lump Magnesite Per Cent	Slag, Per Cent
Silica	2.10	0.45	4.10	3.44	1.75	5.15	6.50
Alumina	0.95	0.75	2.30	1.40	...	1.42	1.02
Lime	85.00	58.30	3.25	...	...	4.70	43.47
Magnesia	11.05	39.24	83.98	...	...	0.72	8.64
Ferrous oxide	...	...	...	...	...	...	21.55
Ferric oxide	...	...	6.70	...	...	...	6.85
Total iron	...	...	...	...	70.00	61.00	21.77
Manganese	...	...	...	...	0.40	0.16	1.01
Calcium carbonate	...	...	...	6.87	...	...	...
Magnesium carbonate	...	...	...	0.53	...	...	...
Calcium fluoride	...	...	...	86.57	...	...	...
Phosphorus	...	...	...	...	0.025	1.44	3.13
Loss on ignition	1.05	...	...	...	...	...	...

About midnight on Saturday the furnace is drained. The bath is worked down so that after the heat is tapped there are not more than 40 to 60 tons in the furnace. Then, as soon as a ladle and crane can be

Table 2—Analysis of Ferroalloys and Spiegeleisen Used

	Molten Spiegel, Per Cent	Ferro Manganese, Per Cent	Ferro Silicon, Per Cent	Ferro Phosphorus, Per Cent
Carbon	4.30	7.00	0.15	0.17
Manganese	16.00	79.50	....	0.15
Sulphur	0.02	...	....	0.65
Phosphorus	0.08	0.20	0.05	18.70
Silicon	1.25	1.00	49.50	0.39
Iron	....	12.30	49.00	77.00
Aluminum	....	....	.30	....

obtained, this metal is tapped and is made into a structural or soft steel heat with the proper additions of ferromanganese, etc.

THE RESULTS OBTAINED

In Table 3, are given the tonnages obtained each month, the number of turns worked since the furnaces were started to the end of August, 1916. The total for the two furnaces is 8073 heats with a total tonnage of good ingots amounting to 830,230 gross tons. This gives an average of 102.7 gross tons per heat. It will be noticed that the best monthly tonnage for the two furnaces was the large total of 50,071 gross tons in December, 1915, and the best tonnage for a single furnace was as high as 30,272 gross tons for No. 15 in June, 1915. The average number of heats per turn for each furnace is 4.14, and the average time from tapping one heat to tapping the next is 2 hr. 53 min. The average tonnage of good ingots per furnace for each turn is 427.6 gross tons.

In order to give an idea of the life of the furnace, a short history of each of them may be given. The first heat was tapped from No. 15 furnace May 29, 1913, and it was run until Oct 5, 1913, being then shut down on account of business depression and repairs. Eight hundred and eighty heats had been tapped. A new roof was built, ten courses of new brick placed in the air checkers and six courses in the gas checkers. The furnace was started again April 12, 1915. On July 16 it was shut down for a new roof and checkers after 838 heats on the roof, 1718 heats on the checkers. Fourteen turns were lost. Nothing more than minor repairs were then necessary until January, 1916, when the furnace was down for a new roof after 1212 heats on

Table 3—Results by Months from Two Furnaces

Period	Furnace No. 15 Turns	Heats	Tonnage	Furnace No. 16 Turns	Heats	Tonnage	Total Tonnage
1913							
May	5½	9	841	....	...	.....	841
June	49	201	18,964	....	...	.....	18,964
July	54	223	22,168	19½	69	6,863	29,031
August	54	227	22,705	50	199	19,736	42,441
September	52	199	20,069	52	197	19,647	39,716
October	5½	21	2,170	52	189	18,960	21,130
November	....	...	.....	31	102	10,030	10,030
1915							
April	34	132	13,056	....	...	.....	13,056
May	51	243	25,418	....	...	.....	25,418
June	52½	284	30,272	....	...	.....	30,272
July	35	179	18,870	31	150	15,568	34,438
August	53	220	23,138	54	218	22,539	45,677
September	54	242	25,252	27	94	9,739	34,991
October	54½	212	22,115	50½	190	19,247	41,362
November	53½	231	24,480	53½	221	23,012	47,492
December	55½	245	25,693	55½	236	24,378	50,071
1916							
January	40	166	17,302	54	222	22,852	40,154
February	51½	228	23,695	51½	226	23,402	47,367
March	55½	244	25,710	41	170	17,611	43,321
April	52	218	22,690	52	218	22,572	45,262
May	54½	228	23,772	54½	229	23,789	47,561
June	52½	225	23,387	52½	218	22,653	46,040
July	29½	111	11,234	52½	196	19,798	31,032
August	54½	225	22,790	54½	216	21,773	44,563
Total	1,053	4,513	466,061	888½	3,560	364,169	830,230

the old one. Fourteen turns were lost. The last repairs were made in July 1916, consisting of a new roof and checkers after 1303 heats on the roof, and 4233 on the checkers. This repair took 23 turns.

No. 16 furnace was started July 22, 1913, and shutdown Nov. 22, 1913, due to business depression. A new roof was built after 720 heats on the old one. It was started July 6, 1915, and ran until Sept. 19, when a new roof and checkers were put in. The heats on the old roof were 499, and 1219 heats on the checkers. Twenty-seven turns were lost. The next shut down was March 20, 1916, when a new roof was built after 1239 heats on the old one. Fourteen and a half turns were lost.

The standing at the end of August, 1916, for Furnace No. 15 was 280 heats on the roof and checkers, 4513 on the ports and slag pockets; and for Furnace No. 16 1102 heats on the roof, 2833 heats on the checkers, and 3560 heats on the ports and slag pockets.

In regard to the quality of the steel made it has hardly been thought necessary to give long tables of heat analyses and the results of physical tests. All the steel has been made to specification, and many of the specifications have been of the most rigid character. It is not too much to say that the steel has fully met all the requirements and has proved to be very uniform from one heat to another.

Discussion

Discussions of the paper were presented by Quincy Bent, Bethlehem Steel Company, and T. W. Robinson, first vice-president Illinois Steel Company.

DISCUSSION BY QUINCY BENT

The Lackawanna Steel Company is, indeed, to be congratulated upon the results which have been obtained. Details of construction of the Steelton plant were published in THE IRON AGE, Sept. 10, 1914. There is a marked similarity to the Lackawanna plant in the open-hearth furnace construction. The methods of operation of the two plants are likewise similar, save for a very few details. At Steelton the principal difference

is the size and location of the Bessemer vessels, the overhead-crane transportation method from the Bessemer to the open-hearth, and the use of bottom, side tap ladles direct from the converters for the elimination of the Bessemer slag.

All duplex processes in general are efforts toward the same end, namely, to divide the work of making steel from iron into two parts: first, decarburizing and desiliconizing; and, second, dephosphorizing, desulphurizing and refining, assigning the first task to the Bessemer converter, which meets the conditions most admirably, and the latter to the basic open-hearth furnace, where again the requirements are most advantageously provided. The details of apparatus and variations of method are, of course, numerous, depending upon individual preference, local conditions and plant facilities.

There are, however, several important features which should be present in the ideal duplex installation: First, an ample supply of molten pig iron, sufficiently high in heat-producing elements to assure warm blows, with or without the addition of a small amount of scrap; second, a fair reservoir of hot metal providing a good mixture of iron as it is produced by the various blast furnaces; third, a close proximity of mixers, converters and open-hearth furnaces, with ample means for rapid and regular transportation between the three divisions; fourth, converters of as large a capacity as practical—25 or 30 tons, three of which can be blown simultaneously; fifth, crane and ladle capacity to collect these three heats and transfer them as a unit to the open-hearth furnace; sixth, proper means for preventing the Bessemer slag from entering the open-hearth furnace, and facilities for the disposal of this slag; seventh, large tilting open-hearth furnaces of 200 to 250 tons capacity, tapping from 90 to 110 tons per heat; eighth, provision for recarburizing heats in the steel ladle; ninth, ample pit room and teeming facilities to handle the open-hearth output.

Unit Production and Cost

As to the production per unit of installation, the most rapid work, of course, is accomplished by the use of 100 per cent hot metal; and on this basis one 200-ton open-hearth furnace can produce from 800 to 1000 tons of ingots per day, provided no delays are encountered in the elimination of phosphorus and sulphur. From this point of maximum production to minimum production, using the straight pig and scrap process at the rate of two heats, or 200 tons per day, is a varying productivity range, depending upon the percentage of scrap used in the open-hearth. The actual percentage of scrap used in these large tilting furnaces will always be governed by commercial conditions, and much thought should be taken to consider carefully the value of the furnace output, the cost of blown metal and the price of scrap.

The cost of plant per ton of ingots, embracing additional blast-furnace capacity, Bessemer and open-hearth, will be fully as great as the cost of stationary open-hearth furnaces per ton of ingots; but the duplex plant will possess a greater flexibility, permitting of maximum output in prosperous times, and still providing economical operation in periods of restricted product. Obviously the most profitable location for such a plant is where molten pig iron production is on a low cost basis as compared with the normal price of melting scrap.

DISCUSSION BY T. W. ROBINSON

Dr. Waterhouse's paper is a valuable contribution to the literature of American steel practice. While primarily a description of the duplex plant and process as used at the Lackawanna works, it covers the fundamentals of a development in this country already important and one that is destined to command greater consideration as time goes on. The term "duplex process" is an elastic one. In the United States it may be considered as specifically applied to the primary refining of pig iron in the acid Bessemer converter, with a secondary and final refining of the blown metal in the basic open-hearth furnace, either of the fixed or tilting type.

In 1876—40 years ago—this country produced a little over 500,000 tons of steel. Nearly 90 per cent was Bessemer, and only 19,000 tons were open-hearth. In 1906—30 years later—our steel production had risen forty-eight-fold, to nearly 23,000,000 tons. Of this, 11,000,000 tons were open-hearth and 12,250,000 tons were Bessemer.

The year 1906 marks the peak of Bessemer steel production in the United States, and will undoubtedly go down in our annals as the zenith of an invention that has perhaps done more for the rapid development of the American continent than any other industrial device. Since then the decline of Bessemer steel in this country has been slow but certain, and open-hearth production has increased by leaps and bounds. Of the 32,000,000 tons of steel produced by our mills last year, 8,250,000 tons were Bessemer and 23,500,000 tons were open-hearth.

Why such a change? Primarily this marvelous transformation in method is the American steel master's answer to the demand for steel of higher quality. In response to this demand, the comparatively complex and expensive open-hearth process slowly grew through metallurgical stress and financial strain. Spurred by decreasing Bessemer ore reserves, and assisted by mechanical invention and metallurgical discovery, its development in recent years has been rapid.

Effect of Duplex Process on Scrap Supply

But the tides of industry, like the ebb and flow of the sea, necessitate equilibrium. Change spells disturbance, and readjustment there had to be, when the open-hearth rose and the Bessemer fell. The result is the duplex process with its balancing influence and its scrap consumption, a process which last year produced over 1,750,000 tons of steel in this country. It may be that the installation cost of the duplex process is slightly less per ton of product than the straight open-hearth melting process. It may also be that the operating cost of the duplex process is somewhat less, at least in some districts. But the underlying cause of the growth of the duplex process is its independence of a steel-scrap supply.

Scrap or its equivalent is an economic necessity for the straight, open-hearth process. It is perhaps reasonable to assume that of our ingot production 20 to 25 per cent is discarded as scrap in the process of manufacture. Probably 7,000,000 tons of our steel production last year went to the melting furnace. To this must be added the reclaim from the nation's scrap pile. While the combined amount is large, our scrap supply is to-day relatively smaller than when the Bessemer converter was dominant with its small scrap consumption. Blown metal may be considered essentially as molten scrap, and the duplex process is an important factor in maintaining the equilibrium of our scrap supply.

New Duplex Plants at Gary and South Chicago

At the South Chicago plant of the Illinois Steel Company several years' experience with Bessemer blown metal in stationary open-hearth furnaces helped to demonstrate the advantages of the duplex process. At the Gary works there will soon be completed a plant consisting of two 25-ton acid Bessemer converters and two tilting open-hearth furnaces, each with a hearth area along the metal line of 46 x 14 ft. This plant may be rated as having a capacity of about 600,000 tons of steel per annum. At the South Chicago works a similar duplex plant is under construction, with the exception that three tilting furnaces are provided instead of two. Two of these furnaces, with a nominal capacity of 600,000 tons per year, will be used for duplex open-hearth steel. The third furnace will serve as an adjunct to two auxiliary 20-ton electric furnaces.

The installations of the duplex process in the United States have thus far been chiefly confined to plants already established. The process as generally practised in this country may be divided into the practice of adding blown metal from an acid Bessemer converter into an open-hearth furnace in which there has been left a residual bath of finished steel, as is the case at Lackawanna, and the practice of adding blown metal to an

open-hearth furnace where only the preliminary oxides, with or without scrap additions, have been prepared, and where the heat when finished is completely tapped. The methods are interchangeable, and the adoption of one or the other is subject to local conditions. When a residual bath is used it is not customary to use scrap on account of slowing down the process. When complete individual heats are made scrap is sometimes used.

Dr. Waterhouse spoke of the use of a "kicker" of partly blown metal. The practice of mixing partly blown metal with full blown metal in the open-hearth furnace is an important element in the satisfactory working of the process on account of the deoxidizing effects of the carbon and the mechanical agitation that ensues. Where only full blown metal is used similar results may be obtained by recarburizing the blown metal with molten pig iron between the Bessemer and the open-hearth; or, as was usually the case with the stationary furnaces at South Chicago, by mixing full blown metal and molten pig iron in the open-hearth furnace.

Quality of Duplex Steel

Dr. Waterhouse's paper refers to the satisfactory quality of duplex steel made at Lackawanna. Poor steel can be made by any standard process. For the highest requirements, open-hearth steel, generally speaking, is better than Bessemer. And by the same token, electric and crucible steel are better than open-hearth. Yet Bessemer steel lends itself particularly well for certain purposes. The metallurgy of steel is not an exact science, and every steel man knows that, whether as measured by chemical analysis, mechanical structure or physical test, it is difficult at times to differentiate between steel made by one process or another.

It is proper to record that, as with our other standard methods of manufacture, we are indebted to Europe for the original development of the duplex process. In Europe, however, the duplex process has been often a combination of the basic Bessemer and the open-hearth, instead of, as with us, a combination of the acid Bessemer and the open-hearth.

More or less prejudice has existed as to the quality of some of the duplex open-hearth steel made in Europe. In this connection, however, it is interesting to recall that at one time there was a good deal of prejudice concerning the quality of straight basic open-hearth steel. But prejudice then, as often now, proved to be but an opinion formed without such a fair consideration of the truth as was necessary for a just determination.

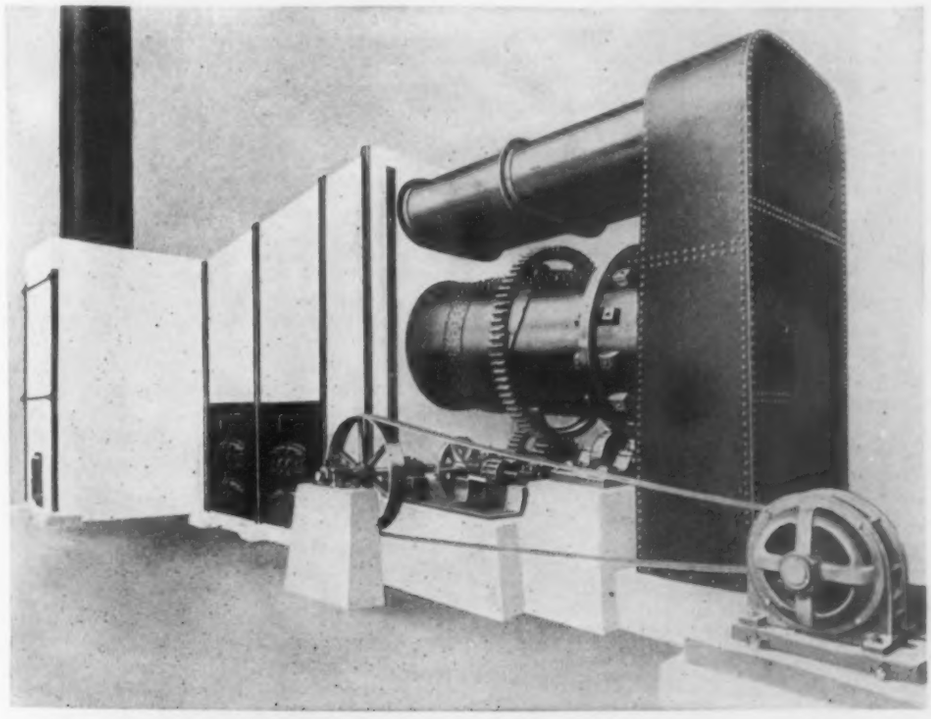
I cannot vouch for the facts as to European duplex steel, but if there has been discrimination it may perhaps be accounted for by the use of the relatively highly oxidized blown metal from the Bessemer converter. The truth probably is that any such adverse opinion as may exist is due rather to individual poor practice than to any inherent defect in the duplex process. Certainly the high quality of American duplex steel tends to substantiate such a conclusion.

Pulverized Coal as Fuel for Open-Hearth Furnaces

BY JAMES WHEELER FULLER*

In recent years pulverized coal has been applied to a large number of open-hearth furnaces, varying in size from 20 to 80 tons per heat. It has been shown that when properly installed on a furnace with the correct design of burners and controlling apparatus, a very marked efficiency has been obtained, also an increased production, in some instances over 50 per cent, and at the same time showing economies between 20 and 45 per cent over the fuel formerly used.

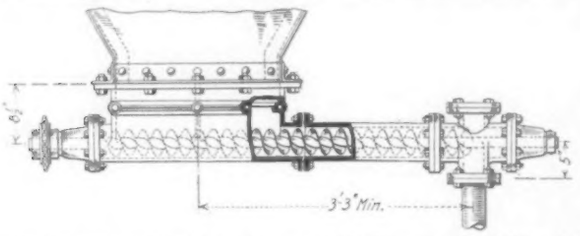
There have been many different types of burners tried out on open-hearth furnaces, but it has been found by actual operation that there is really but one type that is dependable and that gives the highest efficiencies for all things considered. Volume air is admitted to the furnace through the burner. This volume air carries the coal from the feeder discharge into the furnace. At or near the nozzle of the burner a jet of compressed air is applied, which properly diffuses and mixes the coal and the air, so that upon entering the furnace the hot air, which is regenerated and which



The Hot Gases from the Furnace Fire Circulate Around the Outside of the Drier Shell, Passing Through the Combustion Chamber of the Furnace. They then leave the combustion chamber through the horizontal breeching and enter the top of the hood at the lower end of the drier. From this hood the hot gases flow through the interior of the drier shell removing the moisture which has been driven off from the coal and then escape to the atmosphere through the stack

*Fuller Engineering Company, Allentown, Pa.

is about 80 per cent of the air required for combustion, can quickly surround each particle of coal with the proper amount of air for immediate and complete combustion. The nozzle on this burner is so designed that the direction of the flame is under control and can be forced to any particular portion of the furnace. The advantage of this is that it is sometimes desirable to



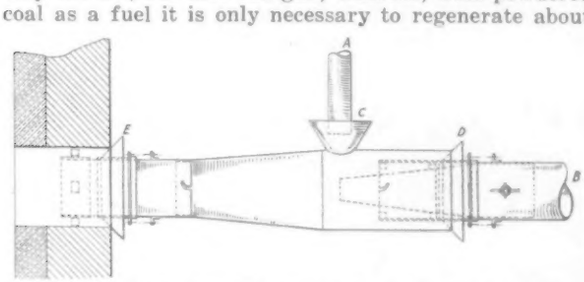
The Pulverized Coal Feeder to the Burner Is Provided with a Long Screw Conveyor. The housing is bored to a neat fit to prevent any flushing of the pulverized coal

melt down very large pieces of material. With proper control of the flame in a powdered coal furnace it can be impinged directly on this material, and will thus melt it immediately without the oxidation losses which are so frequent with other forms of fuel.

With the burner described there are three methods of control: the volume air, the high-pressure air, and also the quantity of fuel delivered to the burner, which will give the furnace operator any condition in the furnace which he desires during each period of the work. This control is positive, and any change of conditions can be obtained immediately. The control is also situated to facilitate reversing the flame in the furnace. In a number of installations this is being done regularly with coal off less than 6 sec., thereby maintaining at all times a high uniform temperature within the furnace, which is hardly possible with other types of fuel over a long period of operations.

PULVERIZED COAL VERSUS PRODUCER GAS

The application of pulverized coal as compared to producer gas in connection with a new installation is much in favor of the powdered coal, in that the investment is considerably less. This, combined with other essential features, makes the cost of a unit about 40 per cent under the cost of one using producer gas. In addition to the cost of the actual equipment required for preparing the fuel, there would also be additional savings effected in the furnace design and construction. For instance, the amount of regenerating capacity would be materially reduced, being only about 60 per cent of that required with a producer-gas-fired furnace; for, with the gas fuel, it is necessary to regenerate not only the air, but also the gas; whereas, with powdered coal as a fuel it is only necessary to regenerate about



The Pulverized Coal Is Discharged from the Feeding Device Into Pipe *A*. Air from a fan at a few ounces' pressure enters from the pipe *B* and produces an injector action which draws the coal and air into the burner through the opening *C*. It also induces air at *D*, the amount of which is controlled by a cone fitted over the air pipe and arranged so it can be moved back and forth, controlling the amount of air admitted. Any additional air required for combustion is induced at the point *E* under similar control

80 per cent of the air for combustion. The roof, too, is simplified in construction, and there is no expensive port construction in the furnace.

One of the features now receiving considerable attention is the proper design of the regenerative chambers so that they will not become clogged with the ash deposit from the powdered coal and can be cleaned without hindering the operation of the furnace. This matter has already been successfully overcome, but further developments are under way, which all indicate that it is one which can be readily overcome and not hinder or prevent the application of powdered coal to this form of furnace.

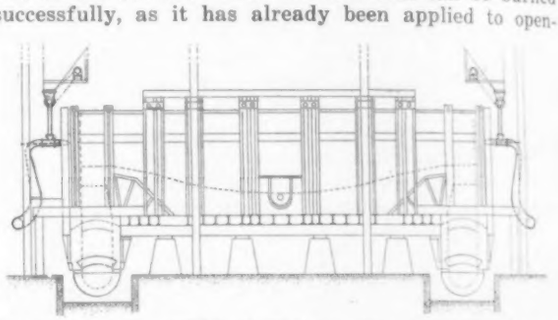
SUMMARY OF ADVANTAGES

Summing up, the advantages offered by the use of powdered coal as a fuel for open-hearth practice are as follows:

Not only are economies effected in the consumption of fuel per ton of product, but there is also a material increase in the life of the furnace refractories; there is a regular, uniform high temperature, which is under the control of the operator; there is increased tonnage, and, in addition to this, the steel produced is of better quality.

Combined with the above features is the lower cost of initial installation, making the use of powdered coal in connection with metallurgical furnaces a very highly efficient and desirable fuel.

From the number of applications of pulverized coal as a fuel, there is no limit, practically speaking, to the size of the furnace in which such coal can be burned successfully, as it has already been applied to open-



The Volume Air, Which Is Between 20 and 30 Per Cent of Air Required for Combustion, Is Supplied from a Fan and Is Control'ed by a Blast Gate Inserted in the Line. In the nozzle of the burner is inserted a jet of compressed air which serves not to increase the velocity of the coal and air entering the furnace but to mix the coal and air. The burner is supplied with a flexible nozzle to direct flame where desired

hearth furnaces of 80 tons capacity, down to small heating furnaces of practically 1 to 3 cu. ft. contents, or having dimensions of 18 x 30 x 16 in.

The first large and successful installation of the application of pulverized coal under stationary boilers is now in operation at the power house of the Missouri, Kansas & Texas Railroad at Parsons, Kan. This installation consists of a battery of eight 250-hp. water-tube boilers of the O'Brien type. The coals which have been successfully burned in these boilers are lignites from Texas and low-grade bituminous coals from Kansas and Oklahoma fields.

Discussion

An extended discussion of the use of powdered coal was presented in contributions from J. P. Kittredge, manager, National Malleable Castings Company, Sharon, Pa.; W. A. James, chief engineer, Lackawanna Steel Company, Buffalo, N. Y., and N. C. Harrison, general superintendent, Atlantic Steel Company, Atlanta, Ga.

DISCUSSION BY J. P. KITTREDGE

The following observations are taken from experience in a plant which started the application of pulverized coal to a basic open-hearth furnace about four years ago.

The first experimental heats were made successfully. The all-important information, as to whether or not the siliceous ash would deposit on the basic slag, was determined by taking frequent tests of the slag during the progress of the heat and comparing them with tests taken in a similar way from the slag of a furnace using oil as a fuel. It was found that ash had little, if any, influence, indicating that it was not being deposited on the slag in any great quantities.

The Experience at Sharon, Pa.

With this point settled and the conclusion reached that high temperature and rapid time could be obtained, the permanent equipment was installed for four 30-ton furnaces and has been in uninterrupted service ever since. The equipment was further extended to serve

three smaller open-hearth furnaces in another part of the plant. The entire open-hearth capacity of the plant is now being operated with pulverized coal as a fuel and approximately 6000 heats have been made to date.

This is cited to illustrate that at the plant referred to the use of pulverized fuel for open-hearth furnaces has passed the experimental stage and has started on the next cycle, which is the slow but gradual development of any new practice.

The time required to make heats is largely dependent upon furnace design, but there has been no difficulty in making heats with pulverized coal in the same time as they could be made with fuel oil, in practically the same open-hearth furnace.

Mr. Fuller has emphasized the matter of decreased oxidation, due to the use of pulverized coal fuel. I regret we have not been able as yet to determine definitely and to our complete satisfaction that such is the case, because of the many variables which enter into melting cold charges, i. e., the nature and analysis of the scrap used, the time the heat is in the furnace, and the condition of the slag. Taken all in all, we can safely say that the oxidation is not greater than with fuel oil or producer gas practice.

Ash and Slag

The large quantity of ash with which we must contend offers by far the greatest problem to solve. Let us reason that with a comparatively small furnace, burning 1 ton of coal per hour, 4 to 10 per cent of such coal is noncombustible. To attempt to pocket or catch all this ash in the checkers would mean an unreasonably short life of the checker chambers before clogging. This readily leads us to conclude that a means of passing as large a percentage of the ash as possible through the checkers, and thence out of the stack, is the most logical course to follow. To reach this result it is also reasonable to assume that the effluent gases containing the ash should travel at a comparatively high velocity and with as few changes of direction as possible. Where the change of direction is unavoidable such places should be accessible so that the deposited ash may be artificially agitated, causing it to be picked up by the draft and carried to the stack. It is quite important that no passageway for the effluent gases through the checkers be allowed to become clogged, as that immediately tends to increase the deposit at such a point.

The slag collected in the pockets of the pulverized coal furnace is considerably greater than that of the oil or producer gas type, and it is important that arrangements be made to facilitate its removal by means of slag cars or otherwise. It should be the aim of the engineer, in designing the equipment, to make the reversing operation, slag removals, and all duties required of the furnacemen and helpers, as free from arduous labor as possible, as the enthusiastic co-operation of the furnacemen is, of course, essential to success.

In conclusion, we have found the results obtained from the use of pulverized coal furnaces to be very gratifying, in regard to economies obtained, and we expect to see wide development in the application of this fuel to metallurgical furnaces.

DISCUSSION BY W. A. JAMES

Our experience in connection with powdered fuel has been almost entirely along the line of firing rotary lime and calcining kilns. Several years ago, however, some attempts were made by us to burn powdered coal under a horizontal water tube-boiler. The coal tried out was rather low in volatile matter and high in sulphur, and, in addition to these objections, the pulverizing was not well done, and the coal not thoroughly dried. We were able to burn this coal under the boiler, though we did not continue the experiments far enough to call it a commercial success.

With reference to our calcining equipment which was furnished by the Fuller Engineering Company I wish to say that we have three 125-ft. kilns, 8 ft. in diameter throughout. The coal used is our regular coking mixture, which is dried by a rotary dryer, pulverized by a Fuller-Lehigh mill, then conveyed to the bins, from which it is fed by screw conveyors to the blast pipes, thence to the kiln burners in the regular way. We are using about 1400 gross tons of coal per month, and estimate the cost of pulverizing and conveying to burners to be about 50 cents per ton.

Some of the advantages derived from the burning of powdered coal are continuous and uniform heating and complete combustion. The heat also can be directed where most needed and the furnaces are practically smokeless. In addition to these very desirable features of operation is the fact that considerable saving in fuel has been shown over both the direct firing of coal on grates and the gas producer practice. As the methods of preparing and burning pulverized fuel are becoming more familiar, it is being applied more generally.

DISCUSSION BY N. C. HARRISON

The question of properly designed checkers and slag pockets is of vital importance in an open-hearth furnace using pulverized coal. To handle the accumulation, the furnace should undoubtedly be designed with removable slag pockets and blowers for the checkers.

We have in our plant three open-hearth furnaces making 50 tons per heat, using only cold stock. Two of these are producer-gas fired and the other fired with pulverized coal. This last furnace was built in December, 1915. As regards the fuel consumption on these two classes of furnaces, we find that the pulverized coal furnace uses from 100 to 150 lb. of coal less than the producer gas furnace per ton of ingots produced.

As regards the life of the furnace refractories and the quality of steel produced, we notice no appreciable difference between the two classes of furnaces, although the increase of production secured by the use of powdered coal as compared with producer gas, is very marked, the average time of heats being cut down 1½ to 2 hr. We have made 50-ton heats of 0.10 to 0.15 per cent carbon steel in our pulverized coal furnace in little over 7 hr., and have averaged over a several weeks' run approximately 8 hr.

I do not believe the cost of an open-hearth furnace installation, using pulverized coal on one furnace only, is any cheaper than a producer gas furnace. But where a number of furnaces, at least three, are involved, the powdered coal installation is undoubtedly cheaper than the producer gas, due to the central coal pulverizing building, which can be built at approximately the same cost for three furnaces as for one. I consider pulverized coal about the best fuel on the market for open-hearth furnaces.

Iron Ores of the Adirondack Region

BY FRANK S. WITHERBEE*

MAJOR PHILIP SKENE, of Skenesborough, now known as Whitehall, N. Y., is probably the first man who mined iron ore in the Adirondack iron ore district. He received, before the Revolutionary War, a grant of about 600 acres from the English Crown, located just north of Port Henry, on Lake Champlain, known as the Skene ore-bed tract. He built a small Catalan forge at Skenesborough, and a fairly well authenticated tradition exists that ore was mined from this tract and shipped to Skenesborough, where anchors, chains, spikes and other needed appurtenances were made to fit out Benedict Arnold's fleet.

No other development in this district is known to have taken place until about 1800, when the Cheever Mine, located in the Skene Tract, and the Arnold Hill Mine in Clinton County, began to be worked in a primitive way to supply a few Catalan forges in the vicinity. But it was not until the completion of the Champlain Canal, which connected Lake Champlain with the Hudson River at Troy, that the real develop-

*President Witherbee, Sherman & Co., Port Henry, N. Y.

ment of the district commenced. With this outlet established, many new Catalan forges were built, and the first charcoal blast furnace was completed at Port Henry about 1822. This furnace was supposed to be the best thus far built. It produced about 25 tons of pig iron weekly.

Perhaps nothing in the metallurgy of iron and steel is more impressive than a comparison of the output of a modern blast furnace with the one to which I refer. Ten additional blast furnaces were afterward built in the district, chiefly in the vicinity of Port Henry, while rolling mills, nail factories, etc., were established chiefly in the Ausable Valley district.

Iron ore was shipped to outside furnaces, and it is an interesting historical fact that Lake Champlain ores were introduced into the Pittsburgh district before Lake Superior ores were delivered there. Pittsburgh also became the largest market for the charcoal billets and blooms made in the district. From 1860 to 1870, the iron industry of the district was at its height, but soon after this period the new Bessemer and open-hearth processes of producing steel commenced to displace the crude and wasteful method of the Catalan forge, and the little charcoal blast furnaces gave way to the larger stacks which used first anthracite coal and finally coke. The small and lean deposits of ore could not compete with the newly discovered and cheaper mined Gogebic and Mesaba ores of Lake Superior, but the larger deposits and more cheaply mined ores have survived this competition, and there is more ore mined in the district to-day than ever before.

PROGRESSIVENESS OF THE DISTRICT

To the credit of the Adirondack district, it can be said that it has always been progressive, as is shown by the fact that the use of electric lights underground and the substitution of dynamite for black powder were first introduced there; and probably nowhere in the country to-day has electrical power for mining been more generally used than in the completely equipped plants of the Port Henry district. The ores are undoubtedly the richest and of the highest grade shipped from any district, being guaranteed from 60 per cent iron in the crude to 65 per cent in the concentrates, and in one special grade a guarantee is given of 71 per cent. Throughout this paper the iron content given refers to the ore in its natural state, not dried at 212 deg. Fahr. As a rule, magnetites carry less than half of one per cent of moisture. The phosphorus content of the different ores runs from 0.005 per cent to 1.50 per cent, although probably 60 per cent of the known deposits are well within the Bessemer limit.

It is an interesting fact that in the Barton Hill mine of Witherbee, Sherman & Co., there was at one time an enrichment of a vein from which over 60,000 tons of crude ore were mined, with only three analysis running below 70 per cent in iron. This is probably the richest shipment ever made from any deposit in this country.

In the Adirondack region to-day two blast-furnace plants are operating, one at Standish, where an exceedingly low phosphorus special Bessemer iron is made from Chateaugay ores, and another at Port Henry, where all grades of iron are produced, including special Bessemer, forge, foundry and basic. The special Bessemer irons frequently carry phosphorus as low as 0.02 per cent, and are regularly sold on a guaranty of not to exceed 0.03 per cent phosphorus and sulphur. Local magnetic ores are used exclusively in both furnaces, and the fuel records from the rich all-magnetic ore mixture compare most favorably with the best practice of the Central West. The Adirondack region is not the ideal one, however, for the manufacture of iron, owing to the very high freights on fuel and the distance from active pig-iron markets.

IRON-ORE OUTPUT

Thirty-six years ago, when magnetite ore was about 35 per cent of the total iron-ore production of the United States, the Cheever Iron Ore Company at Port Henry, Witherbee, Sherman & Co. and the Port Henry Iron Ore Company at Mineville, Palmer Hill and Lyon Mountain in Clinton County, produced about 66 per cent of the magnetite. The remaining 34 per cent came mainly from Pennsylvania, New Jersey and southeast New York. To-day the production of magnetic iron ore comes mainly from the Adirondack region. Two mining districts, Mineville, including the Cheever at Port Henry, and Lyon Mountain produce at the rate of 1,250,000 to 1,500,000 tons of shipping ore yearly. The crude ore carries about 60 per cent iron and the concentrates 63 to 68 per cent. With comparatively small additional development, this production could be largely increased.

The total iron-ore production of the United States in 1916 will approximate 80,000,000 tons, with an average of about 50 per cent Fe. It is well within the range of possibility that the Adirondack field can produce over 6 per cent of this tonnage, and because of the richness of its ores about 8 per cent of the total iron. Moreover, with iron-ore reserves conservatively estimated at 1,100,000,000 tons, concentrating on an average of 2 into 1 of higher than 63 per cent Fe, the Adirondack field promises, on present showing as above, when developed, to produce 5,000,000 tons of concentrates annually for over one hundred years.

The above may seem to be a daring statement to one only somewhat familiar with iron-ore production in the East. It may cause a complete surprise to many whose interests have been mainly centered in the Lake, Minnesota or Birmingham fields.

There are three species of iron ores in the Adirondack field. Straight magnetite, Fe_3O_4; titaniferous magnetite, a mechanical mixture of ilmenite and magnetite, in which titanium varies from 1 per cent to 3 per cent up to straight ilmenite; and martite, Fe_2O_3.

THE STRAIGHT MAGNETITES

As a rule, these are almost absolutely pure, except the mechanical mixture of rock and rock minerals which dilute the ores as mined. Special concentrates are now being prepared by Witherbee, Sherman & Co., running upward of 70 per cent Fe. It is thus practically demonstrated that the straight magnetites of the Adirondack field lack not more than 0.3 per cent of being chemically pure iron oxides. Almost without exception they are amenable to magnetic concentration, the gangue minerals—quartz, feldspar, biotite and hornblende, as well as the magnetite itself—existing as distinct, separate grains.

The most extensive workings of straight magnetites in the Adirondacks are at Mineville, near Port Henry on Lake Champlain, where Witherbee, Sherman & Co. have very extensive and modern mining plants and the largest magnetic concentrating operation in the world. The Port Henry Iron Ore Company also operates the "21 Mine" at Mineville. The other active producers of straight magnetites are the Chateaugay Ore & Iron Company at Lyon Mountain, the Cheever Iron Ore Company at Port Henry, and the Benson Iron Mining Company at Benson Mines. At all of these mines magnetic concentration is employed.

The separation or concentration of magnetic iron ore is a comparatively simple process. It consists in breaking apart the grains of iron, quartz, apatite, etc., by means of crushers and rolls; after screening and sizing, the crushed material is treated by machines equipped with electro-magnets, which pick up or deflect the magnetic particles making so-called heads and tails. The heads are the concentrates and the tails the waste product. This so-called waste product, however, frequently has considerable value. For example, the tailings of the Old Bed 21 ores at Mineville carry so large a quantity of phosphorus that they are used extensively as fertilizers, and the tailings from all grades of ore make a most excellent concrete.

To sum up, the straight magnetites of the Adirondack field are nearly chemically pure. The run of mine, as mined now, varies from 30 to 50 per cent for milling purposes to 55 to 60 per cent for shipment without concentration. Regarding pig iron as the ultimate concentration product—with the Adirondack ores mechanical concentration can account for 72 per cent, the remaining 28 per cent is and must be chemical. Regardless of comparative cost, 70 to 72 per cent Fe is the limit of mechanical concentration. The relative cost of the mechanical and chemical (blast furnace)

will alone set the limit of mechanical concentration, except in the case of titaniferous ores. At present it seems to be established that the commercial limit of concentration is 60 to 65 per cent, except when a specially high-grade concentrate is desired and paid for at a much higher rate.

TITANIFEROUS MAGNETITES

The complete analyses of these ores vary in iron content from normal with 36.8 per cent Fe. and 31.6 per cent. Ti. to 55 per cent to 68 per cent Fe. and 1 per cent to 5 per cent Ti. As distinguished from the straight magnetites, they invariably contain vanadium up to 0.65 per cent V_2O_5. In addition, they carry variable amounts of nickel, chromium, manganese, magnesia, phosphorus and lime. In the Adirondack field there are many occurrences of titaniferous ores, but usually in small bunches or pockets. The one remarkable exception is the Sanford Lake deposit. Trenches, test pits and diamond drill holes have furnished data for safe tonnage estimates. The lowest estimate for this deposit is 70,000,000 to 100,000,000 tons. Even with the work done, neither the lateral extent nor the depth of the deposit has been determined.

The ores have been proved to be amenable to beneficiation by magnetic separators. The ores vary from fine to very coarse grained, yet some of the fine-grained ores separate magnetically as easily as the coarse grained. Some of these ores, however, are entirely unamenable to magnetic separation. This is due to interlamellar growth, alternating layers of ilmenite and magnetite. So intricate is this growth, occasionally even fine grinding fails to break apart the ilmenite and the magnetite. Several experiments, however, showed that coarsely crystallized titaniferous ores crushed to 40 mesh, treated with a hand magnet yielded heads that carried 64 per cent Fe., 3 per cent Ti., and 1 per cent metallic vanadium. The vanadium of the crude ore went entirely with the magnetite. Typical analyses follow:

	Sanford Crude, Per Cent	Sanford Concentrate, Per Cent
Iron	50.52	58.39
Titanium	11.71	6.19
Phosphorus	0.009	....

The great proved tonnage of the Sanford Lake deposit compels it to be acknowledged as an addition to the ore reserves of the Adirondacks, even though they are not commercial to-day. It seems quite probable that, when transportation facilities are provided which will put these ores on the market, exploration will disclose other deposits in other localities, especially since the mining of the Sanford Deposit will probably show structural features not now known. The Adirondack gabbro field, therefore, though covering 1500 to 2000 square miles or more, is not counted on to contribute further to the estimated reserves.

MARTITE ORES

As the third class of iron ore, martite, is of a very limited occurrence and is found exclusively associated with the straight magnetites. Martite, as is well known, is an ore with the crystallization of magnetite and the hematite formula. In Clinton County it is nearly 33 per cent of the iron content of one large ore body. When the ore body in which martite is found is of shipping grade as mined, it is rather beneficial than detrimental. In a milling ore, however, the case is quite different, since martite is non-magnetic. When, therefore, martite is a considerable per cent of the total iron in milling ores, other concentration processes must be used in connection with the magnetic, otherwise heavy losses in the tailings will be unavoidable. The known occurrences of martite are, however, very rare.

Whatever may be thought of the estimated tonnage of the Adirondack region this is a fact: The class of iron ores in the Adirondack field is the only one where, by purely mechanical operations, the ore can be brought to 70 per cent or 72 per cent of purity, with pure iron 100 per cent. This fact alone is one worth considering; that in the best blast-furnace practice from 75 per cent to 85 per cent of the consumed fuel is used for maintaining the reduction temperature above, leaving 15 per cent to 25 per cent fuel for reduction. It is within the range of possibilities that with an oxide of iron, free from all impurities, some direct process may be discovered which will eliminate the blast furnace and convert these practically pure concentrates directly into a semi-finished steel product. If, however, no further economic use can be made of the purity of these ores, this is worth consideration. In a 70 per cent concentrate there is only 30 per cent of the inert units on which freight must be paid, as against 50 per cent on a 50 per cent ore, or 45 per cent on a 55 per cent ore. Even with present mill practice at Mineville and Lyon Mountain, no trouble is experienced in bringing concentrates to a 62 per cent to 68 per cent grade.

The question may be asked how we are able to assert at the present time that the Adirondack region is capable of producing such an enormous tonnage of iron ore in comparision with what was thought to be its maximum tonnage a few years ago. The improvements in modern mining methods and machinery, together with modern crushing and preparing machinery and magnetic separation, have made it possible to utilize ores that are low in iron but mined at a moderate cost which a few years ago had no market value whatever.

THE MARKETS FOR THESE ORES

Brief reference may be made in conclusion to the markets past, present and prospective, for the ores under discussion. As has been said, prior to the discovery and development of the Lake Superior iron-ore ranges, the ores from the Adirondack and Lake Champlain district were largely used in Pittsburgh and vicinity, but were gradually driven back into their more legitimate district east of the Alleghenies, where for several generations they have formed the basis of the mixture in blast furnaces. The selected lump ore from the Port Henry mines has also been used for very many years as a fix in puddling; and later, with the development of the basic open-hearth furnace, this ore has come into almost universal use east of the Alleghenies as an oxidizing agent.

The recent rapid development of the East furnishes a market much in excess of the capacity of the developed mines of the Adirondack section at the present time, and plants are obliged therefore to secure the balance of their ore mixtures from foreign countries or from the Lake Superior fields.

The Dominion of Canada offers a market by no means negligible for the ores mined near Lake Champlain, and steel plants in the Dominion have for many years been large buyers. In passing, it may be of interest to note the fact that in 1895 about 40,000 tons of high phosphorus Port Henry ore were exported to Germany and England, making, it is believed, the only over-seas shipment of United States ores on record.

The cost of hard ore mining, with the cost and waste of concentration, is, of course, higher than that of the steam shovel operations of the West; but mining costs compare favorably with those in underground mines in the Lake Superior region.

The freight rates from the Adirondack region to points of consumption in the East compare most favorably with the rates paid on Lake Superior ores to similar points. Using Port Henry, the largest shipping point in the region, as a basis, an analysis of freight cost shows the following:

	From Port Henry, Per Unit	From Lake Superior Mines, Per Unit
To Lehigh Valley	$0.0254	$0.0485
To Schuylkill Valley	.0262-0270	.0485
To Central Pennsylvania	.0292	.0485
To Pittsburgh	.0317	.0372
To Mahoning-Shenango Valleys	.0317	.0320
To Buffalo	.0206	.0203

The all-rail rates to the principal consuming points are grouped into districts and range from $1.30 to $2 per gross ton, while a uniform rate of $1.45 per gross ton prevails to the East from Lake Erie ports. For the purposes of comparison the following table, giving the freight costs per unit metallic iron, will be interesting. I have used 63 per cent Fe. for Adirondack ores and 51.50 per cent for Lake Superior ores, and have assumed $1.05 as a total freight rate from Lake Superior mines to lower lake ports.

From the Adirondack mines (including Mineville) to the trunk line railroads or to Lake Champlain, there should be added to the foregoing figures from one-third to one-half cent per unit, to cover cost of terminals or mine railroads.

In the spring of 1917 the enlargement of the Champlain Canal will be completed. This is a part of the Barge Canal system of the State of New York and will provide a waterway between Lake Champlain and the Hudson River with a channel 12 ft. deep and a minimum bottom width of 75 ft. To overcome comparatively slight elevations, there are 11 locks of the following dimensions: usable length 311 ft., width 45 ft., 12 ft. over miter sills.

Less than 20 miles of this waterway is through a land cut. The balance of the total distance of 61½ miles, from Whitehall at the southern end of Lake Champlain to Waterford, is by means of the canalized Hudson River. This waterway will offer a means of transportation from Lake Champlain to New York Harbor, thence by rail to furnace plants, which will result in lowering the above rates very materially and will still further increase the differential in favor of the Adirondack ores.

From the above freight analysis it will be observed that the Adirondack district commands a most favorable location with regard to a market for its ores, particularly for eastern plants. With furnaces located on the Hudson River, New York Harbor or elsewhere on the Atlantic Seaboard, the freight on an ore supply would be remarkably low. From mines tributary to Lake Champlain it is safe to say, from trial shipments actually made on the partially completed canal, that the total freight from mine to alongside New York Harbor will be approximately one cent per unit metallic iron.

While many millions of tons of concentrated ores have been shipped from Lake Champlain mines, and many more millions of tons of high grade crude shipping ore have been moved from this district, it is frequently said that the "surface has hardly been scratched." And many competent authorities believe that the future will look toward this region more and more as one of its greatest sources of raw material for the rapidly increasing needs of its iron manufacturers.

Discussion

Frank E. Bachman, of the MacIntyre Iron Company, Port Henry, N. Y., commented on Mr. Witherbee's paper as follows:

Mr. Witherbee has so thoroughly covered the geology and available supply of iron ore in the Adirondack region that but little remains to be said.

During my connection in 1914 with the smelting test of titaniferous ores for the MacIntyre Iron Company, a report of which appeared in the Institute's Year Book for that year and to which I hope in the near future to add a report of further investigations, I became familiar with their ore reserves. In addition to the Sanford Hill deposit containing 70,000,000 to 100,000,000 tons, there are the Iron Mountain deposit, which recent drilling shows to contain as much or more ore than Sanford Hill, and the Calamity and Mill Pond deposits, estimated to contain 40,000,000 tons. Mining on Sanford Hill and Iron Mountain will be by open cut, these deposits ranging from 500 to 1200 ft. wide and having almost no overburden.

The physical characteristics of all these ores are such that they can be easily concentrated. The ore used in the furnace test was mined at the base of Sanford Hill. It was concentrated in four different mills, none of which was designed to meet its special requirements. These tests proved that by crushing to pass a ¼-in. mesh, the concentrates produced contain 55.00 to 56.50 per cent Fe., 7.00 to 8.25 per cent Ti., a trace to 0.004 P. As shown by Mr. Witherbee, crushing to 40 mesh increases the iron in the concentrates to 64 per cent and reduces the Ti. to 3 per cent or less. The Iron Mountain, Calamity and Mill Pond ores are richer in Fe. and lower in Ti. than those from Sanford Hill, their crystal is larger and the interlaminar growths of ilmenite are less. It is therefore to be expected that ¼-in. concentrates made from them will be higher in Fe. and lower in Ti. than are the Sanford concentrates of same size.

The furnace test of titaniferous concentrates having demonstrated that iron is produced from them with lower fuel consumption than from non-titaniferous magnetites of same iron content, that their mixture with non-titaniferous magnetites tends to decrease furnace irregularities, and having indicated that owing to the greater rapidity of their reduction they make a better mixture with Lake ores and straight magnetites, the value of his ore reserve is apparent.

LOW COST IN NEW YORK HARBOR

The average composition of the Sanford Hill deposit is such and the overburden so light that not more than two tons of material will be mined per ton of concentrates produced. In a quarry operation, this will not cost to exceed 30c. per ton. With water power on the property which can be developed cheaply, the concentrating cost should be less than 20c. per ton of crude. Assuming a rail freight at 1c. per ton per mile on the 60 miles of road necessary to bring these ores to the Champlain Canal and a 35c. per ton canal freight to tidewater at New York harbor, we have a cost of but $1.95 per ton for a 57 per cent. ore alongside New York, or less than 3½c. per unit. If the ore is crushed to 40 mesh and the iron content increased to 64 per cent., necessitating clinkering or sintering before use, the cost will be increased to 1½c. per unit but will still be well below lowest cost of ores delivered at Eastern furnaces.

The tailings from each ton of concentrate contain an average of 850 lb. of recoverable ilmenite, which it is expected will soon be used for the production of a material for which there is a wide sale. I am advised the plant to produce this material is now being erected. If the product proves as valuable as the tests indicate, the ilmenite from the tailings is likely to be of greater value than the ore.

CONCENTRATES IN THE BLAST FURNACE

For ten years I was directly connected with the exclusive use of magnetically concentrated ores in the blast furnace. During this period I used all of the ores then produced on the eastern slopes of the Adirondacks. I found the only difficulties connected with their use were those due to their size and, where the crude ore mined was of variable composition, to the variable composition of the concentrates produced.

The flue dirt loss using magnetic concentrates is greater than when using fine Lake ores. On this account a furnace using them cannot be driven to a product equal to that which the same furnace will make when using fine Lake ores. Increased flue dirt production is due to the non-plastic nature of magnetic concentrates. Owing to the weight of the concentrates and their granular structure, their distribution in the furnace requires a great deal of attention. Unless very large charges are used and the bell opened suddenly, the ores trickle through the coke charge along the furnace walls, leaving an open center. The distribution question was solved at the Northern Iron Company's Standish furnace using the exceptionally fine Chateaguay concentrates by clinkering three-eighths of the mixture. The practice was further improved by enlarging the furnace hearth and steepening the bosh. Since these changes were made the yearly average fuel consumption, while making low phosphorus iron, has been less than 2200 lb. of coke per ton of iron. At the Port Henry furnace, where no coarse ore or clinker is available, the shotty nature of the concentrates makes their distribution more difficult. The distribution question has never been entirely solved. The best results have been obtained by using a double bell so constructed that the ore is distributed in two concentric rings. The fuel consumption of this furnace has never been under pound for pound over long periods, but has ranged for year periods at from 2240 to 2340 lb. per ton of iron produced, the product being basic, foundry and malleable.

Annual Meeting of Machine-Tool Builders

Larger Attendance and Greater Interest than at Any Previous Meeting—President Doan Discusses Co-operation Among Manufacturers

With the unprecedented registration of 166 members and guests, the National Machine Tool Builders' Association held its fifteenth annual convention at the Hotel Astor, New York, Oct. 24 and 25. It will go down in the records of the association as one of its most interesting and profitable gatherings. Much of the real work of the convention was done in executive meetings of the whole body and of the several committees and is therefore not available for publication, but the addresses delivered at its open sessions had a measure of constructiveness and a meed of inspiration that made them worthy of a far more extensive review for the benefit of all industry than is made possible by the space at our disposal.

Address of President J. B. Doan

The dry routine of the opening features of the convention was enlivened by the carefully prepared address of the president of the association, J. B. Doan, American Tool Works Company, Cincinnati. After pointing out that there can be no honorary memberships in an association of machine-tool builders, Mr. Doan made a plea for co-operation in these words:

"Men have learned that co-operation is one of the necessities of business success. By combining our wisdom we learn better methods of manufacture; we learn that there is some better system of business than merely trying to cut the throat of a competitor; and we find that the concentrated rays of business friendship, like concentrated sunbeams, will melt the coldest and hardest markets. In other words, co-operation and the exchange of business ideas teach us to manufacture more scientifically, to keep costs more accurately, and to market our product more successfully. So let this membership get together, abandon business suspicion and build up business confidence.

"There never was a time when these fundamental laws of success were so essential to business men. We are living in the most momentous days of history and are witnesses of the results which follow when national suspicion becomes national fear and national fear turns to national hatred, leading to international destruction. . . . Such associations as ours keep alive in our country the great spirit of national trust and national co-operation.

ELEMENTS OF INFLUENCE ON THE FUTURE

"As far-seeing business men living in these historic days, there are three elements of profound influence on the future which I would suggest that we consider deeply: First, the effect of the international war in Europe on our future, both at home and abroad. Second, the effect of the enormous business expansion which has come about in this country as a result of the war, both in the enlargement of old machine-tool factories and the adddition of new ones. Third, the effect of whatever changes in national laws may be made after the forthcoming Presidential election."

At this point in his talk, President Doan dwelt upon the economic conditions likely to prevail in Europe after the war and drew a comparison with the South after our Civil War. He then continued:

"None but those who are blind and deaf can fail to comprehend that there will be terrific effects following the ending of the European war. . . . It will be a time for wise heads to acquire and use greater wisdom than they ever before possessed. No one can accurately forecast that future. It's all in the second act of the great tragedy now being enacted.

"In the United States there has been immense business development during the last two years. Old machinery has been put in shape for work and new machinery has been built with breakneck speed. New buildings have been erected, and expansion has been the order of the day in the machine-tool industry along with others. Our demand has been due to the enormous call for machinery and supplies of every kind from Europe. We might picture business in America as a great forge made white hot as the demand from Europe has blown upon it like a mighty bellows. The anvils have rung, the workers have toiled, and still the cry has been for more, more. But this Hercules of war will grow weary. The giant bellows will lose its force. Will there then be a sufficient demand to keep all busy? America wants and needs all the prosperity it can get, so in the midst of unprecedented prosperity let us not forget to prepare for other days.

OUR RELATIONS WITH OTHER NATIONS

"In the days that are to come we need to enlarge our vision and build up the friendliest possible relations with other nations. In building up that business, the fundamental principle still holds. Tell exactly what your machine is when you try to sell it, and make it exactly as you have agreed to make it before you ship it. We want no soft spots in machine tools, no matter where they go. We are going to meet these different nations in the future, not merely on foreign soil, but perhaps on ours. . . . It will tax the ingenuity of Americans to meet that competition of the future. America is in a condition of the fat and well favored to-day. The old adage was, 'A lean hound for a long race.' We will have to race with a lean and hungry hound after this war, so let us prepare for it."

The speaker then discussed the political future from a non-partisan standpoint, laying stress upon the point that each member of the association could do much for the permanent well-being of American life by giving straightforward information on the greatest of American industries, the fundamental industry, the building of machine tools, to the law makers. In closing, he said:

"We represent an industry that is fundamental in the world, more fundamental to-day than ever before. The struggle of the world has become one of machinery against machinery. If we did not know it before, the European war has taught us this fact. The nation with the largest and most powerful machinery, and the most of it, wins. . . . Our lathes, our turret machines, our planers, our milling machines, our fine mechanical devices of every nature are the war weapons of civilization. We represent a great industry. We manufacture the mechanism which keeps men always at the topmost point of civilized development. It is an honor to be a machine-tool builder. It is a great honor to be a builder of good machine tools. It is more than an honor—it is a national responsibility, as it never was before, that the machine-tool builders of America should be the builders of the best machine tools. Gentlemen, let us be worthy of that responsibility."

Discussion of Health Insurance

The program of Tuesday morning's session ended with the delivery of a notable paper on "Health Insurance" by Frank F. Dresser, Worcester, Mass. This subject is so broad and the speaker handled it at such length and so comprehensively that it is possible in the following digest to touch upon only the most outstanding parts of the paper.

The passage of the New York workmen's compensation act in 1910 and the adoption of the principle by other States mark a striking change in our philosophy. The laissez-faire theory, that the welfare of the State is surest to be found by permitting the individual to work out his own salvation in his own way free from undue interference by others or by the State itself (a

theory which we were wont to believe accounted for the progress and the political freedom of both England and this country) was abandoned and in its stead the collectivist theory was adopted, that the welfare of the State as a whole should be striven for because if the State is prosperous its members will be and therefore individual needs and desires must be subordinated to the advantage of the mass. The surprisingly rapid and widespread approval of this philosophy has made possible the advocacy of measures which ten years ago would have seemed utterly repugnant.

Health insurance, unemployment insurance, invalidity insurance and old age pensions are possibly on the threshold of enactment while further advances are likely along the lines of widow's pensions, minimum wage, regulation of hours of labor and treatment of industrial disputes with which we are already familiar.

THE MOVEMENT FOR HEALTH INSURANCE

The American Association for Labor Legislation after considerable study drafted a uniform bill for health insurance and last winter presented it to the legislatures of New York, New Jersey and Massachusetts. It will be presented again to these bodies and to others the coming year.

Health insurance is not a new matter abroad. Bismarck proposed the first compulsory health insurance law in Germany in 1883 as a sop to the Socialist party. Austria and Hungary followed in 1888 and 1891, Luxemburg in 1901, Norway in 1909, Serbia in 1910, Great Britain in 1911, Russia and Roumania in 1912 and the Netherlands in 1913. Systems other than general compulsory insurance are found in Belgium, Italy, France, Spain, Sweden, Denmark and Switzerland.

A belief so universal must have its effect here, however much we think our conditions differ from those of Europe, in the existence of the need and in the peculiar difficulties to be met because of our constitutional guarantees and because of the competitive burden on the States which first adopt the law.

One of the commonest causes of reduction in income or increase in expenditure or both is the illness of the wage earner or his dependents. This illness loss means, to all people of slight resources, a reduced standard of living and consequently a greater susceptibility to disease. It is an efficient cause in recruiting the ranks of the casual worker and the inefficient. It fills our hospitals, jails and poorhouses and drains the resources of our charities. For illness is the chief cause of poverty and the poverty stricken are by far the fairest marks for disease.

But the wage loss and expenditure are not the only need. Medical advice, because of its cost, is not obtained except as a last resort and frequently too late, and even when secured is too apt to be careless or unskillful. It has been said, I do not doubt with truth, that "there is perhaps a distance of a quarter of a century between the present status of medical science and that of medical practice among the poor."

THREE GENERAL FORMS USED ABROAD

We may readily admit that such conditions among the great majority of our people are not well for the State and cast about for remedies. In foreign countries one of these three general forms has been adopted:

1. State subsidy to the voluntary insurance organization whose cost is borne about one-third by the State and the rest by the insured workers themselves, of which Denmark is a type.

2. Compulsory insurance, with freedom to choose the insurance carrier, and the cost divided between the employer, employee and the State, which is the English plan.

3. Compulsory insurance in a closely prescribed insurance carrier under State supervision at State expense, with the cost divided between the employer and the employee, which is the German system.

The proposed bill of the Association for Labor Legislation inclines toward the German plan. (At this point the speaker explained at considerable length the provisions of the bill. The cost provision of this bill distributes the burden two-fifths to employees, two-fifths to employers and one-fifth to the State. The employer is required to make a payment to the insurance carrier each pay day and is permitted to deduct the employee's contribution from the wages paid him.)

Like all other legislation based upon the collectivist theory, the proposed enactment looks to the advantage of a class and not of an individual and rests upon the principle that the more fortunate or efficient or thrifty among the insured as well as the community at large shall share the burdens of the weaker members of society. It looks not to the strengthening of the survival of the fittest, but to the preservation of the less fit.

Its proponents justify the contribution of the State and of the employers by saying that the workers cannot bear the necessary cost themselves and must be helped, that it is to the advantage of the State to diminish its expenditure for poor relief and to have a well and self-sustaining citizenry, that it is to the employer's advantage to have more efficient and constant workers and that to some degree both the State and the employer are responsible for illness among the insured class.

The cost of the plan is problematical. The data in this country are of the vaguest description and such foreign data as are available are difficult to transpose into our terms. We know that the German costs have been rising steadily since 1884 and that the peak of expenditure is not yet reached, that the days of sickness per insured have increased rather than diminished and that the duration of illness has lengthened remarkably. A similar condition is observed in other countries having an insurance system.

It has been computed, arguing from German and British experience but realizing almost the total lack of necessary data, that the cost of the sickness, medical and funeral benefits, including administration costs but excluding, apparently, any contribution to reserves and the quite considerable sums which employers must in the first instance pay for their accounting department, would be between the limits of 3 per cent and 5 per cent, say about 4 per cent, of wages.

If we apply this 4 per cent of wages to a single State, say Massachusetts, assuming the average wage to be $570 a year and that there are about a million persons who would be insured, the cost to Massachusetts is about $23,000,000 annually, of which the workmen would contribute nearly $9,000,000, the employers $9,000,000 and the State about $5,000,000, an increase of our present State tax by over 40 per cent.

The proposed benefits and the consequent cost are at the minimum and experience shows that once the bill is enacted the extension of its benefits will become a political slogan and their cost an ever increasing burden.

In spite of the common belief that the State and the employer have, just under the treasurer's desk, a hidden stock of gold which, if it can be got at, will prove inexhaustible, these contributions will not all remain where they first fell, but be passed on. The State's contribution, as well as its payment as employer of State and municipal employees, is raised by the general levy upon all taxpayers. The employer's contribution plus his increased State and municipal tax will become an item in his cost of production to be charged, so far as possible, in the competitive rivalry of the several States, in the price of his product and paid by the consumer or else be saved by greater economy, as, for example, by reducing wages. The greater portion of the consumers are the insured workmen and their families who thus, besides their own direct contribution, will indirectly bear in the increased cost of necessaries or in less wages a large proportion of the contribution of the employers and the State. In this, therefore, as in so many similar proposals, it would seem that the class which it is hoped to benefit is simply set to chasing its own tail again.

The first query is whether compulsion may be effected in any other way than by this administrative device of making the employer an insurance collector. It might be possible to enforce insurance by providing that no servant shall be hired or retained in an employment unless he is or has been insured for a certain period, and to collect his insurance payments by his

purchase of stamps and entry of them in an employment ticket. It would avoid one serious consideration at least. The payment of wages ought not to be entangled with anything but money paid for value given. Any deduction made by an employer from the pay envelope, however slight it may be, is a constant incentive to the worker to make up the deficit by asking increases of pay. Collection through the employer also creates a very considerable cost.

There are certain other considerations which render contribution by the State or the employer unwise. So long as the public thinks the employer and the State are paying any part of the cost it will be willing to have them pay more. The worker, already reasoning from the fallacious analogy of workmen's compensation, will seek to escape any contribution and the public, not realizing the incidence of the cost, will not object. Thus the Legislature influenced by political considerations will year by year extend the scope of the statute, increase its benefits, alter the proportions of contributions and the like and just as we have noticed in our compensation legislation where, for example, in the five sessions since the Massachusetts act was passed it has been altered in sixty-four particulars.

The employer seeking to diminish his sickness cost may take the obviously preventive course of not employing men likely to be sick. The defective men of any age or the man who, reaching forty-five, has entered upon the period of increasing illness hazard will be excluded from regular employment and, at a time of his greatest need, see his opportunities of earning reduced. Instead of making it easier to employ such men a course is taken which is best fitted to enlarge the class of dependents; and this is not a fanciful condition, for England has noticed its effects.

The time for choice has come. Shall we permit these crude and uncertain legislative regulations to continue, shall we agree that industry is responsible for certain preventable inducements to disease and inflict upon ourselves and upon the community the rule of thumb penalty of health insurance, or shall we of our own motion study our conditions and set about to cure their evils, whether they be evils in the mills or in the general health conditions of our towns?

Progress along these lines by industrial employers themselves, progress by wise State and municipal regulations which shall reach all classes, closer study by the medical profession of their peculiar problems seem to me far preferable and to offer greater hope than to embark upon the uncharted sea of health insurance.

Dr. Friedensburg, former president of the senate in the Imperial Insurance Office (retired), after over 20 years of service, ends an article on the practical results of workingmen's insurance in Germany with the words, "I deem it a deed well done to have called attention once again to the all-pervading cancer that is destroying the vitals of our State."

Other Proceedings

Tuesday afternoon was given over to committee meetings, and Wednesday morning to an executive session and further committee meetings. On Wednesday afternoon, James A. Emery, Washington, delivered an address on "Industry and Politics" which was received with so much enthusiasm that it was immediately voted that the address be printed and distributed among the members.

An executive session was then held for the consideration of reports and resolutions and for the election of officers for the ensuing year. All the officers of the past year were re-elected as follows:

President, J. B. Doan, American Tool Works Company, Cincinnati; first vice-president, D. M. Wright, Henry & Wright Mfg. Company, Hartford, Conn.; second vice-president, Aug. H. Tuechter, Cincinnati Bickford Tool Company, Cincinnati; treasurer, A. E. Newton, Reed-Prentice Company, Worcester, Mass.; secretary, Charles L. Taylor, Taylor & Fenn Company, Hartford; general manager, Charles E. Hildreth, Whitcomb-Blaisdell Machine Tool Company, Worcester.

Five new members, as follows, were added to the rolls of the association: W. W. & C. F. Tucker, Hartford, Conn.; Cincinnati Grinder Company, Cincinnati; Sipp Machine Company, Paterson, N. J.; Nutter & Barnes Company, Hinsdale, N. H.; Fitchburg Grinding Machine Company, Fitchburg, Mass.

The next meeting of the association will be held in Cincinnati, May 21 and 22, 1917.

OBSTACLES TO METRIC SYSTEM

Difficulties in Its Adoption Pointed Out by Coleman Sellers, Jr.

In connection with the inquiry which the Philadelphia Bourse is conducting among manufacturers and exporters of a variety of industries as to their attitude toward the general adoption of the metric system in the United States and the extent to which their foreign business now requires it, the following statement has been made by Coleman Sellers, Jr., president and engineer of William Sellers & Co., Inc., machine-tool manufacturers:

"I would certainly recommend exporters to make any use of the metric system that will facilitate their foreign business, such as expressing weights and dimensions in the units used by the purchaser, if he so desires. The Bourse is to be commended for putting the necessary information before manufacturers and exporters, but I should be very sorry to see it lend itself to any propaganda designed to force the use of the metric system on the whole country by act of Congress.

"The French units have been legalized by our Government and accurate standards have been prepared for distribution. This, I think, is as far as the Government should go. I am perfectly willing that any one shall make what use of the metric system he deems desirable, but I object seriously to any attempt to force the extension of the system by legal enactment. The advocates of this course are no doubt absolutely sincere in their belief, but they approach the subject too much from a scientific point of view and do not give due consideration to the practical side. If the system is really better than ours, it will in time supplant it without the violent disturbance which would follow an enforced use.

"Our own foreign business is chiefly confined to machine tools or other machinery for working metals, and the metric system is only involved to the extent that we occasionally are required to furnish the principal screws with metric threads, or to arrange a machine to cut metric threads; that is, threads in which the lead or pitch is expressed in millimeters instead of in inches or fractions of an inch. Even this requirement is not universal. We are now building machines for Russia (a metric country) which are required to cut inch threads. It really makes no difference to the buyer of a machine whether the inch or the millimeter has been the unit of measurement used in constructing it.

"As to the use of the system in our own establishment, I may say that when we began the manufacturing of the Gifford injector about 1860 we followed the drawings of the French inventor, using his units, and all our gages and tools were made accordingly, with the single exception that the threads for the pipe connections conform to the American standard. We have continued to use the metric units in this department since it started, with entire satisfaction, but with no desire to extend it to the rest of our establishment.

"To change a manufacturing plant such as ours from one system to the other is not so simple a matter as merely substituting a rule differently graduated, but it involves a large investment in tools and fixtures and an interference with established standards which it is practically impossible to change. This difficulty is very real, as is illustrated by the fact that even in France the metric system is not used to the entire exclusion of other standards; and in other countries, Russia for example, the English system of threads still generally prevails. The matter of thread standards is in a chaotic state in the meter-using countries, and they have not yet agreed to conform with a universal standard of diameters, pitches and forms of thread, although

numerous efforts have been made to bring this about. In fact, the subject is in the same confusion that existed in England before Sir Joseph Whitworth introduced his system of screw threads which was suggested by the late William Sellers and officially approved by the Franklin Institute."

In commenting upon Mr. Sellers's statement, the Bourse states that it is in complete agreement with his view that the metric system cannot be forced suddenly upon this country by legal enactment.

American Shipbuilding Company's Report

The American Shipbuilding Company, Cleveland, in issuing its seventeenth annual report covering the fiscal year ended June 30, 1916, presents the following income account, including subsidiary companies:

Earnings after deducting manufacturing expenses		$1,643,645.60
Other income		165,123.94
Total income		1,808,769.54
Deductions:		
Administrative and general expenses	$369,394.89	
Taxes	149,166.02	
Repairs to machinery, equipment, etc.	362,805.32	
Depreciation	325,472.48	
Interest	22,624.04	
Net profit for the year		$579,306.79

The net profit presents a strong contrast to the returns for immediately preceding years. The net profit for the fiscal year 1914-15 was $5,405.63, and for the fiscal year 1913-14 was only $2,804. The balance sheet of the company and its subsidiaries shows a surplus at the close of business, June 30, 1916, of $3,361,023.77, against a surplus 12 months before of $2,971,234.51.

President M. E. Farr, in his accompanying remarks to stockholders, says:

"The present activity in the Lake carrying trade, influenced largely by the unprecedented demand for steel and iron products, and the marked shortage in ocean tonnage, account almost wholly for the present prosperous condition of your company. The company has for many years confined its operations to the construction and repairing of Lake vessels, and was, therefore, not well prepared in the way of organization and equipment to undertake the building of ships intended for salt-water service. When the demand for this type appeared stable, the working forces of the several plants were reorganized and certain necessary equipment was bought and installed. During the first half of the fiscal year contracts were closed for six ships of Norwegian type, and the experience gained in constructing these ships warranted the closing of many more contracts at attractive prices. The greater part of the earnings shown accrued during the last half of the business year. This showing does not reflect the maximum earning capacity of the company.

"The commerce of the Great Lakes is in a very prosperous condition. The demand for carrying tonnage has been steady and at good rates of freight. The prevailing high prices for ship materials and labor have limited the placing of orders for Lake ships to the actual necessities of shipping interests. A large number of Lake vessels have been sold and taken to the Atlantic coast to engage in coastwise and other deep-sea service.

"During the current fiscal year four ships, with a total carrying capacity of about 37,000 gross tons, have been completed and delivered to owners. There are now 33 ships with a total carrying capacity of about 174,000 gross tons under contract for delivery during the next fiscal year, and two ships with a total carrying capacity of about 21,000 gross tons under contract for delivery during the last half of 1917. Present prospects are favorable for securing enough contracts to fill all building berths for 1917 delivery. The volume of repair work has been large and profitable.

"Many improvements have been made, including a large concrete drydock at the South Chicago plant, which was completed in November, 1915, at a cost of $355,826.81. Sundry buildings and equipment have been added to various plants at a cost of $442,357.06. In order to permit the enlargement of our Wyandotte, Mich., plant, 10.4 acres of land was purchased, at a cost of $60,000. The cost of this land and all improvements has been paid. In order to get higher efficiency and greater economy in our production, it will be necessary to replace obsolete tools and equipment with modern ones, and also to add other much needed equipment.

"The prospects for future business and earnings are good, and the affairs of the company are in excellent shape. The shortage of materials and skilled labor has hampered operations and restricted production. Indications are that this condition will improve. Our workmen are paid the highest wage in the history of the shipbuilding industry, and their working conditions receive careful attention. The officers, directors and operating heads have co-operated with the management in every way, and these men have been untiring in their efforts to make your company one of the most stable and at the same time one of the most profitable concerns of its kind."

Steel Conductors for Electric Transmission Lines

The possibility of using steel wires and cables for electric transmission lines was discussed by H. B. Dwight in a paper presented at the convention of the Association of Iron and Steel Electrical Engineers at Chicago, Sept. 18-22. The paper points out that the effective resistance and reactance of iron and steel conductors increased to a maximum as the current is increased and then decreased. In most cases, especially with larger cables, the decrease is slow and the resistance maintained approximately at its maximum value for most large values of current. This property can prove useful in transmission line work for conductors where they have low impedance with a normal load current, but about double the impedance to a current flowing as the result of a short circuit.

The higher conductivity of steel for direct current than for alternating current makes the use of bare steel cables for direct current often more economical than for alternating current lines, according to the author. The steel cable has eight times the resistance to direct current that a copper cable of the same size has, and seven times the resistance of a copper cable of the same weight. Inasmuch, however, as galvanized steel cables usually cost less than one-seventh as much as copper cables per pound, they should be more economical, other things being equal. Steel cables have been used on transmission lines for spans up to 3000 ft. or more. In some cases they have formed the support of copper conductors, but often they themselves carry the current.

Another application of steel conductors is their use for lines transmitting a relatively small amount of power. Thus a line to transmit 75 kva. a distance of 7 miles, would require, if constructed of copper, a wire large enough to transmit 750 kva. This is due to the mechanical properties of copper, a smaller wire being too weak to be safely used. A steel line small enough to transmit 75 kva. will have ample mechanical strength to withstand all ordinary contingencies of wind, ice, sleet and snow. While poles and insulators will cost the same in both cases, steel conductors will cost only $220 against $2,600 for copper. The use of steel conductors on moderately long, small capacity lines will make it profitable for power companies to enter a field where otherwise the cost would be prohibitive.

In a decade the zinc concentrate production of the Broken Hill mines of New South Wales has greatly increased, 506,660 tons having been exported in 1913. In 1905 the exports were only 103,532 tons, increasing to 520,518 tons in 1912. Of the latter the spelter contents paid for were 194,214 tons. The British Government has agreed to take 100,000 tons per year of Australia's zinc concentrates during the war and for 10 years thereafter and to also purchase 45,000 tons of spelter to be produced in Australia, which will represent 115,000 tons of concentrates.

Zinc Dust by a New Process

The production of zinc dust by a new process was discussed by Harry J. Morgan and Oliver C. Ralston in a paper, "Electrolytic Zinc Dust," before the fall meeting of American Electrochemical Society in New York, Sept. 29, 1916. Mr. Morgan is research fellow, University of Utah, and Mr. Ralston is assistant metallurgist, U. S. Bureau of Mines.

The author's introductory remarks together with a statement of the cost of the process and the conclusions are as follows:

The sudden increase in the price of zinc dust after the beginning of the European war, owing to the cutting off of the German and Belgian supply, led to the conducting of some experiments on the possibility of its production on a commercial scale from solutions of zinc, and the substitution of the zinc made in this manner for the zinc dust ordinarily used in the precipitation of gold and silver in the cyanide process.

The United States, in 1913, imported 4,382,470 lb. of zinc dust, valued at $227,585. Most of this was from either Germany or Belgium. The domestic production, in comparison with the imports, was very small. In the years 1912 and 1913 it was 492 and 423 tons respectively, while the imports were 2400 and 2200 tons respectively. For a time the zinc dust made in zinc smelters was a drug on the market and when first utilized in cyanidation could be bought for a lower price per pound than solid zinc. After the advantages of the use of zinc dust for precipitation were realized, so much zinc dust began to be used for this purpose that it brought a premium of about 3c. per lb. over what the value of spelter was at the beginning of the war.

COST OF THE PROCESS

Due to the high consumption of electrical energy, 3 kw.-hr. per lb. (6.6 kw.-hr. per kg) of zinc dust, the principal item to be considered is the cost of electric energy. The high efficiency of the zinc dust in comparison with ordinary zinc dust and the high efficiency of the latter in comparison with zinc shavings precipitation, will probably allow of considerably higher cost per pound for the new dust than for zinc shavings, or ordinary commercial zinc dust.

The high current density used allows of smaller electrolytic tank equipment than is used in most electrolytic installations. The design of a small set capable of supplying the ordinary small cyanide mill with zinc dust is hence a matter of interest. We believe that the figures presented allow of the design of such plants, but until a semi-commercial plant has been built and tested out thoroughly it is needless to present possible designs. The object of this work, as likewise of other investigation which has been conducted by the Salt Lake station of the Bureau and the Department of Metallurgical Research of the University of Utah, has been to test out various ideas and suggestions with a view of determining whether or not they possess sufficient merit to warrant their being tried out on a semi-commercial or commercial scale.

CONCLUSIONS

By depositing a "sponge" metal from solutions by electrolysis it is possible to get a zinc product that on drying crumbles into "zinc dust."

Sponge metal can be obtained from zinc sulphate solutions by the continual addition of a small amount of either copper or arsenic salts to the electrolyte. The objection to the use of zinc dust prepared by this method is the needless dilution of the bullion caused by the copper, and the danger met in the handling of gold or silver precipitates when arsenic is used to produce the sponge. These difficulties are probably not insurmountable. Fairly impure solutions can be worked only when zinc sponge is desired, and this will not handicap the ordinary electrolytic methods.

The preparation of zinc sponge is also possible from sulphate solutions by keeping acidity low and temperature high. Zinc oxide, rendering the solution slightly basic, is the most desirable chemical for maintaining this condition. It is subject to the objection that it is only slowly and slightly soluble in zinc sulphate solutions.

The same remarks apply to zinc sponge prepared from chloride solutions, except that the zinc sponge seems to be more inclined to be oxidized during drying.

Sodium zincate solutions allow of the deposition of zinc sponge under a widely varying range of electrical and thermal conditions. Stirring of the electrolyte must be avoided. Current efficiencies of about 60 per cent and zinc dust precipitating efficiencies of 70 to 75 per cent are possible. There seems to be no difficulty in getting 1 lb. of zinc dust from a solution of zinc, with 3 kw.-hr. of energy.

Sodium zincate solution recommends itself because of its ease of preparation from caustic soda and zinc oxide, both of which are articles of commerce. The zinc tenor of the solution can be maintained either by the addition of more zinc oxide or by the use of zinc anodes, by which latter process spelter can be converted into zinc dust.

British Iron and Steel Research

At the autumn meeting of the Iron and Steel Institute in London, Sept. 21 and 22, the president, Sir William Beardmore, presented the recommendation of the council that committees be formed to report on new developments in the industry and to assist in obtaining practical papers thereon. Five committees were suggested dealing respectively with mining, fuel and refractories; pig iron and foundry practice; steel and alloys; mechanical treatment, and physics, chemistry and microscopy. In addition, a research committee might be formed to suggest and advise on subjects suitable for investigation and research. The council advised that the committees consist of about eight members each, holding for four years, the terms of half of them expiring each two years. The research committee, it is proposed, will consist of one or two members of the council and one from each of the five committees.

Commenting on this recommendation by the Institute, the London *Times*, in its Engineering Supplement, says:

> It is yet another sign of the new spirit in industry that the Iron and Steel Institute, without relinquishing the high status it has long enjoyed as an international association, is considering measures to strengthen its national standing and is promoting work designed to benefit British trade. There has been apparent recently, throughout the great industry of which the Institute is fully representative on the technical side, a determination to get rid of that dependence on German sources of supply, which it is now realized has hampered British capacity for production in the past. Steps are to be taken not merely to bring about a union of interests with other old-established technical institutions in the Midlands, the Northeast Coast, and Scotland, but to form local committees in the overseas dominions to report on new developments and strengthen the commercial relations with the mother country. In view of the need of additional research work into such problems as those referred to in the previous note a research committee is to be formed, and other committees will be constituted to assist progress in the fields of mining and fuel, pig-iron and foundry practice, steel and alloys, mechanical treatment, and physics, chemistry and microscopy.
>
> The suggestion that the borders of the Institute should be enlarged by the inclusion of a new associate class to be formed of the younger men engaged in the scientific and technical branches of the industry will be generally approved, although it may be doubted whether the proposal made by an eminent past president of the Institute to open the doors to women associates will meet with acceptance.

With an American locomotive of the decapod type, a member of the engineering board of the Russian Ministry of Ways of Communication has established a new European record for the most heavily loaded train. He brought over the Nikolaief division of the Southern Railway a train with a load of 4424 tons. Its length was 2800 ft. and signaling was done with flags. A Russian engine was tried out against the American and the superiority of the latter was clearly established. An Odessa paper of Sept. 5, 1916, states that a number of American freight cars are giving great satisfaction on the Ekaterininskaya Railway because of their great capacity.

Judicial Decisions

ABSTRACTED BY A. L. H. STREET

TRADEMARKS AND NON-COMPETING ARTICLES.—The originator of a trademark covering one kind of goods cannot complain of the appropriation of the same brand by another manufacturer for another and non-competing kind of goods. "Valid registration of a trademark is acquired, not by the invention or adoption of a word or symbol, but solely by affixing it to an article of merchandise as a mark; it is the trade, not the mark, that is protected." So it has been held by the courts there is no infringement of a trademark in its use by one manufacturer to cover automobiles and by another to cover fire extinguishers. It may be deceptive, and therefore morally wrong, for a manufacturer to adopt a name under such circumstances that the public are apt to be deceived into believing that in buying his product the goods of another manufacturer, who in fact does not make goods of the particular class, are being secured; but, in the absence of a showing that the guilty manufacturer is causing injury to the other's trade in consequence, the latter has no right of action, although the former may profit by the use of the mark under such deception. And when there is nothing to show that the complaining manufacturer's reputation has been injuriously affected by the other manufacturer's use of the same brand, through the sale of inferior goods, such use will not be enjoined upon a mere suggestion of the possibility of such injury occurring. (United States District Court, Eastern District of New York, Aunt Jemima Mills Company vs. Rigney & Co., 234 Federal Reporter, 804.)

PHASES OF PATENT LAW.—On a claim of infringement of a patent and a dispute as to the patentable novelty of a machine, immediate commercial success of the machine will resolve the doubt in favor of the patent. (United States Circuit Court of Appeals, Second Circuit, Eibel Process Company vs. Remington-Martin Company, 234 Federal Reporter, 624.) Patentable invention will be prima facie presumed from the issuance of a patent in regular and proper form. As affecting legal liability for infringement, a patentee is bound to take notice of all pre-existing devices pertaining in any way to his device. (United States District Court, District of Oregon, Brown Portable Elevator Company vs. Interior Warehouse Company, 234 Federal Reporter, 649.) In ascertaining the profits derived from using a rolling-mill furnace which constituted an infringement of a patent, as a basis for an award of damages to the aggrieved patentee, the inquiry being limited to the saving of labor cost, the proper standard of comparison was with the furnaces in previous use by defendant and replaced by the infringing furnaces. And, the improved furnaces being of unitary character, the complaining patentee is entitled to recover the entire in the cost of the heating operation as between the two types of furnace. In compelling the infringing manufacturer to account for profits derived from the infringement, he is not entitled to any deduction on account of the cost of changes made in equipment sold, to make it satisfactory to the buyer. (United States Circuit Court of Appeals, Third Circuit, Morgan Construction Company vs. Forter-Miller Engineering Company, 234 Federal Reporter, 324.)

RIGHT TO RESCIND PURCHASE—DAMAGES FOR BREACH OF WARRANTY.—A buyer of belt guides and shifts could not rescind a completed purchase on the ground of a breach of warranty, without showing reservation of a right of rescission in case of a breach of warranty, or fraud on the part of the seller. Damages recoverable by the seller for a breach of warranty as to the condition of a thing bought are to be measured by the excess of the value of the article contracted for above the value of that delivered. (North Dakota Supreme Court, Elliott Supply Company vs. Johnson, 159 Northwestern Reporter, 2.)

"IMMEDIATE" RETURN OF UNSATISFACTORY MACHINERY.—Under a contract for the sale of machinery, giving the buyer the right to return it on condition that the return be made "immediately" after failure of the machinery to do good work, a delay of 40 days bars the right to return. (South Dakota Supreme Court, Purcell vs. International Harvester Company, 159 Northwestern Reporter, 47.)

VALIDITY OF CLAYTON ACT.—The provision of the Clayton act, prohibiting agreements binding a lessee or purchaser of goods or machinery not to use or deal in the goods or machinery of a competitor of the lessor or seller, is valid as applied to interstate transactions. (United States District Court, Eastern District of Missouri, United States vs. United Shoe Machinery Company, 234 Federal Reporter, 127.)

Customs Decisions

CARBURETERS

Another and an unsuccessful attempt has been made before the Board of United States General Appraisers to expand the agricultural implement provision of the tariff act of 1913 in such way as to admit under its provisions carbureters manufactured for oil-burning traction engines. The J. D. Richardson Company, Detroit, appeared as the protestant of record, it being shown that the carbureters involved in the suit were made by the Windsor Machine & Tool Company, Windsor, Ontario, for the account of the M. Rumely Company, La Porte, Ind. The collector regarded the articles as falling under the provision in the law for "manufactures of metal, not specially provided for," and accordingly took duty at 20 per cent. The importer, on the other hand, held that the carbureters should be deemed "parts of agricultural implements," and as such given free entry. In support of this contention, witnesses testified that the carbureters were used only in the traction engines turned out by the Rumely Company. These engines, it was testified, were employed for hauling hay or potatoes to the market or heavy loads along roads.

Judge Fischer said the same protestant was before the board on this issue last April when the claim for free entry was overruled. Later, however, the question was reopened at the request of the importer, who desired to introduce additional testimony. With this further evidence before it, the customs tribunal again found against the claim for free entry. The attitude of the board relative to claims of this kind was summed up by Judge Fischer in his decision, coincided in by the other members, as follows:

> From this testimony we think it is clearly obvious that these traction engines are primarily and solely intended for hauling purposes, and that they possess no function which in the remotest degree could be considered "agricultural" in character. The fact that one particular type of engine may prove peculiarly adaptable for hauling agricultural products will certainly not operate to make such an engine an agricultural implement. It still remains, what its internal mechanism inevitably constitutes it, a hauling engine, and its definite status as such will not be changed merely because it may prove advantageous to use the engine for some particular line of work.

SPLIT RINGS FOR FISHING TACKLE

The Enterprise Mfg. Company, Cleveland, won before the board in a contention relating to the classification under the present tariff law of split steel rings used in the manufacture of fishing tackle. Duty was levied at the rate of 30 per cent under the provision in paragraph 136 for "fishing tackle or parts thereof," while the importer's contention was for a rate of 15 per cent under paragraph 114, as articles made of wire, or at 20 per cent under paragraph 167 as "metal manufactured not specially provided for." It developed that the rings were not used in completing fishing tackle until they had been copper-plated and burnished. The decision said that, admitting that the steel rings were employed chiefly in the manufacture of fishing tackle, the board was confronted with the fact that they were never so used in the condition as imported in the present case. In view of this circumstance, it was held the prevailing judicial constructions on the subject required that they be excluded from the tariff provision for parts of fishing tackle. It was held that, inasmuch as the rings were made from steel wire, they were properly classifiable as manufactures of wire at 15 per cent as claimed. The alternate claim for a rate of 20 per cent under the metal manufactures provision was not considered applicable by the board.